

Aviation Week & Space Technology

February 18, 1963

NEW PHOTOS:

Soviet Aircraft,
Missiles in Cuba

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Operating at over 40,000 feet in a specially modified KC-135 jet aircraft, a team of "Typing physicists" from Aerojet General's Astronics Division is conducting a series of unique experiments in the study of ballistic missiles. Their purpose: to obtain highly reliable data on the radiation characteristics of missiles in flight... data which provides design parameters for future warning and deterrent systems. Their research tools: infrared trackers, radiometers, spectrometers, and spatial measurement devices. These studies, known as Project RAMP... Radiation Airborne Measurement Program... are a joint Advanced Research Projects Agency/Air Force Aeromedical Systems Division project. ■ Astronics Research has been active in radiation physics for over eighteen years. Its scope of activities encompasses radiation physics, systems research, space physics, and competing sciences. Areas of special interest are advanced detection, tracking, and guidance systems, with applications ranging from surface warfare devices to infrared satellite surveillance systems.



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HIGH CLAMP-UP MEETS MACH 2 STRUCTURE NEEDS

Enter the speed, more varied the mission... the more critical are the structural requirements. Such is the Navy's newest air-sea-set, nuclear weapons carrying aircraft - the carrier-based A3J Vigilante.

Because of their excellent residual payload characteristics, Hi-Lok were selected for use throughout the A3J primary structure. The unique Hi-Lok torque-off feature produces a high, and uniform clamp-up of high tensile sheet materials in air gap conditions. The installation method is smooth and quiet. Inexpensive, lightweight, Hi-Lok tooling reduces worker fatigue and avoids the need for heavy squeezers or bulky pull-tight equipment and their limitations in close quarters. In open areas, Hi-Loks can be installed at speeds up to 45 per minute.

Write or contact us for Hi-Lok technical and specification data.

hi-shear
CORPORATION
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Hi-Lok ■ Hi-Lok are being installed in the A3J rear fuselage with Hi-Lok 90° angle tooling mounted in a Ratcheting Hi-Post Master. Other Hi-Lok angle tooling is available or simple to fashion and offset angles to accommodate difficult or tight clearance conditions resulting from the unusual structural requirements of high performance aircraft such as the Vigilante.



ABOVE: In strength and temperature range, the A3J rear fuselage steel Hi-Lok meets 0.25" shear at 200,000 psi tensile load and 10,000 psi in 0.005" deflection with a 100% shear ratio. From the A3J rear fuselage, 11,000 F-class primary fasteners were used. Hi-Lok parts \$18.000 per shear in 110,000 (30,000 per fastener) with shanks made to 100 mm as well as head heights to 100 threads.



Look into

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FOR EXAMPLE: PROJECTS

A major contribution to today's most sophisticated radar tracking and range systems are the following principles: antenna pointing, star-tracker, beam-steering, the use of advanced processing techniques. Thus module 10 contains microchip 2, 3 and 4 and contains a processor (typical) compatible with engine requirements of 5 seconds of arc, capable of processing 250000 Hz in local and an intermediate processor with accuracy of 100 degrees in 10000 Hz.

Potential and related system problems are usually solved through our experience and technical engineering and production capabilities.

Qualified engineers and technicians are needed immediately for these University of the Virgin Islands research facilities in a confidential basis for Research and the use



AEROSPACE CALENDAR

Feb. 28-Mar. 2-11th Annual Technical Conference Society of Plastics Engineers, Statler Hilton Hotel, Los Angeles, Calif.

Feb. 28-Mar. 1-Government Contractors' Meeting, Conference, Statler Hotel, Los Angeles, Calif., and National Union Inn, Pasadena, Calif.

Mar. 5-7-Sixth Annual Hydrazine Conference, Statler Hotel, and Space Manufacturing America Society of Mechanical Engineers, Statler Hilton Hotel, Los Angeles, Calif.

Mar. 6-8-1960 Annual Meeting, American Society for Testing Materials, Statler Hotel, Philadelphia, Pa., Calif.

Mar. 6-9-Fifth International Symposium on the Properties of Polymers, Dresdner Polytechnikum, Dresden, Germany.

Mar. 6-7-Fiveth Annual Symposium, Biodegradable Textiles, Biodegradable, Calif. Specialty Information, Inc.

Mar. 8-11-Annual Meeting, American Conference Ann's Publishing Division, Bookbinders by APEL, Hotel New Yorker, New York City, N.Y.

Mar. 8-9-National Symposium Meeting, WPA/NASA, Los Angeles Research Center, Hotel California, Cleveland (Clevelet).

Mar. 11-13-Electric Propulsion Conference, American Institute of Aeronautics and Astronautics, NASA, Los Angeles Research Center, Calif.

Mar. 18-20-16th Bi-Annual Computer Conference, Institute of Electronics and Electrical Engineers, California Institute of Technology, Pasadena, Calif.

Mar. 24-26, 1960, April, Flight Testing Conference, American Institute of Aeronautics and Astronautics, Hotel Greenbrier, White Sulphur Springs, W. Va.



NEMS-CLARKE MODULE

Searches and locks carrier to ≈ 145 dBm

When missile and satellite signals are hard to track, and hold, the new PCMU module is at its best. It can often lock to tracking, and demodulate with an amplitude-locked loop. It receives, tracks and locks using a carrier signal at low as -143 dBm and will maintain the lock at -159 dBm. ADG of this equipment has been maintained for signal strength lower than locking threshold. Ultra linear phase detector guarantees low distortion especially with a signal modulation as high as 1.4 radians. These new units demonstrate either a tri phase or amplitude modulated signals.

The module is designed to plug into Novis-Clarke 1435-1456A receivers as well as the 800T deep space probe receiver.

Specifications:

distorted Notes	Autumn, Mixed
Autumn's Twenty Songs	21: 5/12/01-12 100+ entries
Mixed Group Songs	100+ 100+ 100+ various HCs frequency 1/4-8/11-16
Teaching Song Broadcasts	28 & 81 entries
	Individuals listed present
Teaching Song Broadcasts	Autumn, CCA (also March 1991) -84 (also Autumn 1991) & 2001

Postscript: Please see issue 100 of *PostScript* for
a full report on the 1990 meeting.

AVIATION WEEK & SPACE TECHNOLOGY, February 15, 1993

*R*emained

Systems engineering management production field services

VITRO SISTEMI



American and Eastern Pilots
will fly this picture on the 727

At the industry moves toward lower-banding equipment, early unprepared instrument displays and positive failure warnings become increasingly important. □ Colleen has had 18 years of researched leadership in flight director and flight display computers with American and Boeing's new systems, with those major factors. Two color

Approach Hazzards with Improved lighting, large warning flags, warning monitor outputs which permit use of a modern composite warning system, digital coarse indifusion and digital readout for DMIB in the Corne Infusor. For complete information as how this experience can benefit your floaters operations, contact

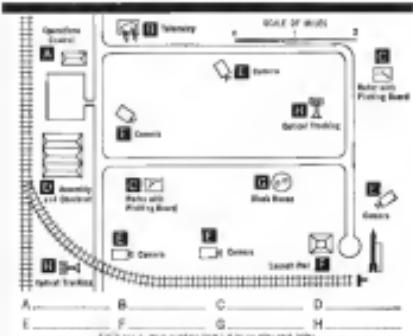
COLLINS RADIO COMPANY
Cable Sagida • Dallas • Los Angeles
• New York • International, Dallas



AEROSPACE CALENDAR

Continued from page 21

Could you design a
TIMING SYSTEM
for this installation?



on multi-line displays, after [Boden et al. 2002a,b](#).

EECO "off-the-shelf systems" answer all fire code requirements for test facilities.

How would you use EEDD routing applications to design a 100-percent Using system? But this hypothetical spans multiple branching facilities.

If you can't reach the Using system, you'll need to establish the possible route of the using and data recording sites shown in the map of an imaginary branching facility.

4. EEC/EEC III AAC Line Design for retarding
modulated time delays and just
was approved over line for all telephonic
switching systems to ensure other line for
long distance calls.

which is now accepted, was to also include a small

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SPACE AGE NEEDS**

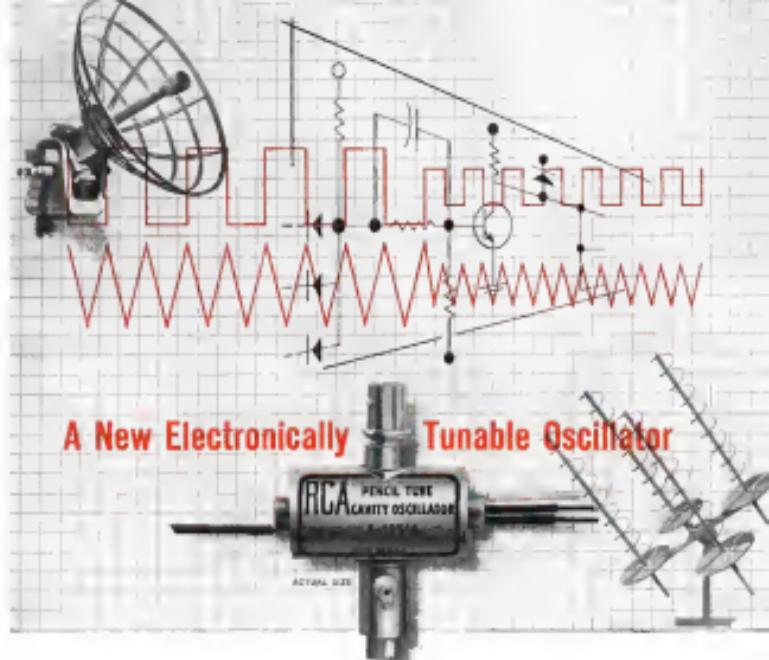
Pruschauf's vast resources for the designing and producing of space-age equipment have provided a wide range of military products... from standard and custom vans, shelters and trailers to advanced aerospace ground handling equipment. On both prime and subcontract, Pruschauf's engineering know-how has consistently demonstrated its capacity for handling the toughest problems... swiftly, efficiently.

Freshfield capability played an important part in the celebrated flight of the X-15 ... the world's first man-occupied winged space flight. Freshfield supplied North American Aviation, working under the National Aeronautics and Space Administration, with Anhydrous Ammonia Tank Trailers for fueling the X-15 prior to take-off. Freshfield also provided box tanks for surviving the X-15 from the B-52 mother ship while in flight.

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A New Electronically Tunable Oscillator



RCA L and S BAND VARACTOR-TUNED INTEGRAL-CAVITY "PACKAGED" MICROWAVE DEVICES MORE VERSATILE AND EFFICIENT THAN KLYSTRONS

BCA's new varistor-based integral-cavity pencil tube, A15314, operating at 1180 Mc, makes possible electronic frequency control in applications such as radar receivers, spectrum analyzers, radio surveillance equipment and telecommunications.

The array can be mechanically scanned between 1885 Mc and 1895 Mc and electronically tuned ± 10 Mc from any preset frequency within this range. Tuning sensitivity is approximately 8 Mc/volt. Power output over the tuning range is 2000 watts.

The integral packaging of the varactor with the cavity makes possible either electronic frequency control or frequency-modulated output. As such, the device has many advantages over klystrons, including: better frequency stability in an FM system under conditions of varying beam and plate voltages and thermal temperature changes. Further advantages are lower input power, smaller size, and lower cost.

For additional information see chart at right. Application specifications are available by writing: BARTEC, Wheelabrator Division, 34999 State St., Monroe, MI 48161.

General Data - RGA-AT5014		
Electrical		
Heater Voltage	120 VAC	Watts
Heater Power	1000	Watts
Maximum DC Power Voltage	5000	Volts
Maximum DC Power Current	32	Amperes
Minimum DC Power Voltage	8	Volts
Optical Properties - Frequency Modulated Oscillator		
DC Plate Voltage	1.05	Volts
DC Plate Current	.38	Amperes
Heater Watt	-.16	watts
DC Plate for Frequency Modulating Oscillator	30	Volts
Peak Frequency	1840	Hz
Peak Frequency Modulation	10.00	Hz
Minimum Power Output	.005	Watts



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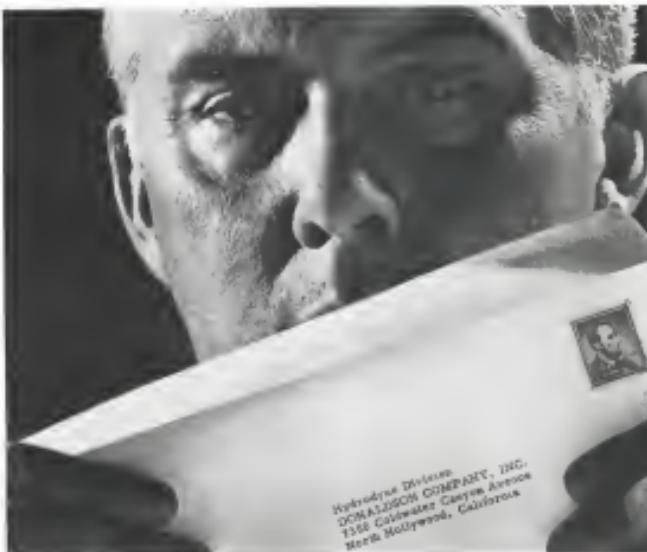
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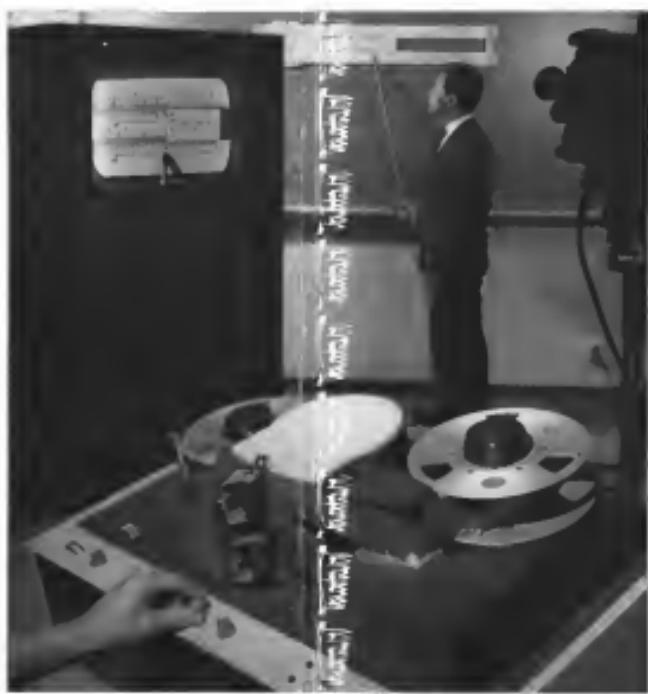
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*not unique

developing time—or costs. And video tape is cheaper to record and more than 50 mm film you can erase tape and re-record an edit your requirements very. Teachers will find the VR 1800 easy to operate on household current and it's the first of its kind machine made of a metal frame. For recording, it can use the VR 1800's many dubbing recorders, tapes and other memory devices for every application. Amplex Corporation 504 Charter Street Redwood City, California 94063 and serves throughout the United States and the world. Team Recording and Testing met today.



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- Increased rotor diameter for better maneuverability
- Greater payloads for armament systems
- Constant supercharged power at high altitude and hot temperatures
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Armed with M60 machine guns, the new Sioux augments the nation's braced war capability. The OH-13S plus its big brother, the heavily armed UH-1 Iroquois, form Army Aviation's most striking team in the new Air Cavalry Troop.

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ELECTRONIC COMMUNICATIONS, INC.
ST. PETERSBURG, FLORIDA

Aviation Week & Space Technology

February 18, 1963



...the spectacular Navy Hydrofoil will depend on Vickers Hydraulics

Here again is a demonstration of the adaptability of hydraulic components and controls. One of the first hydrofoil craft to undergo extensive fleet testing will be the submarine chaser PC(18), now being built for the U.S. Navy by Boeing Aerospace Division.

Since this type of craft will operate at high speeds and under weather extremes, reliability of ball-bearings steering and hydrofoil control is a vital design requirement.

Among areas in which Vickers hydraulic systems will find application on this 118-ton craft are:

* starting drives for the three engines

* steering • drives for sonar • drives for the autopilot system (In-barre operation)

Extensive and retentive of the struts will be accomplished by Vickers drives as will actuation of control slugs on the hydrofoils. Other Vickers products play a role in protecting the struts and in checking-on the hydraulic systems.

* * *

For more information on marine hydraulic applications, call your local Vickers Application Engineer or write the Marine and Ordnance Department, Waterbury 28, Connecticut.



WD-98

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Number 7

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PLAINFIELD, NEW JERSEY

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EDITORIAL

NASA Needs A Watchdog

With the national space program intended to spend about \$30 billion of the taxpayer's hard-earned money during the next decade it is time that Congress created a permanent watchdog over the National Aeronautics and Space Administration. This would ensure that that agency adequately pursues the national goals set for it, and enhances the substantial sense of public manner it appears likely to gain with a reasonable degree of off-cost. The need for a congressional watchdog for NASA does not imply that there is anything basically wrong with the agency as present, or with the capabilities it has been given. The point is simple: that any publicly financed program of the magnitude of the national space program needs constant surveillance to be a responsible cut-back group to keep it from straying both technically and morally.

The national space program is still so unknown that most of the congressional effort in this field has rightly been devoted to getting NASA organized, funded and moving. But with the multi-billion dollar budget allocated NASA last year an additional billion and a half committed for military space activities, and a total NASA Defense Dept. space budget request of over \$7 billion for Fiscal 1964, it is high time that Congress set up adequate machinery for continued technical surveillance of space agency activities.

It is unfortunate that at the very time the need for this activity is growing acutely, the chairman of the House Science and Astronautics Committee, Rep George Miller (D-Calif.), appears ready to turn the clock back to the days when the late Quentin Brooks controlled this committee's effectiveness (AW Feb. 1, 1960, p. 21).

McCormick's Key Role

For a variety of reasons the House space group has played the key role in congressional space policy. This is in contrast to most major policy matters in which the Senate committee is the vital force. Dominance of the House space group stems from the original wise and vigorous leadership provided in its early days by Rep John McCormick, now House Speaker. It also stems from the relatively strong and enthusiastic membership from both parties on this committee, in contrast to the apathetic approach from its Senate counterpart, composed primarily of older men too kindly concerned in other important fields. Under the initial leadership of Ray Miller, who succeeded to the chair after Mr. McCormick's death, the House space group blossomed into productive activity. This was primarily because the subcommittee chairmen were appointed and then acted vigorously in their assigned areas to achieve enough things that the congressional former policy of apathy ended as a consequence of the whole under the dictatorial domination of the chairman, could never accomplish.

The record of the subcommittees during 1962 was outstanding, both in achieving the first really effective review of the major NASA program authorizations and in delving into special areas where management

patterns were impeding technical progress such as the Centaur, Advent and Astra programs.

Chairman Miller recognized the inauspicious procedure of having the 25 man committee function as a whole in trying to cover the broad scope of the entire NASA program, and broke it down into four subcommittees, each of which could devote intensive effort to a major portion of NASA's activities. These subcommittees basically followed the agency's own organizational division into manned space flight, space science, advanced research and technology applications, tracking and data acquisition.

These subcommittees reacted enthusiastically to their task and produced a 3,000 page report that represents a comprehensive review of NASA's present programs. In addition, they entangled some unenlightened NASA-Prague brain on project Astra and Cape Canaveral. This exposed the faulty of the Prospector lunar exploration program, with its terminals stepped forward that of the Apollo manned lunar effort, and found that NASA had bettered for the H-350 and the required test year for the solid-fueled Nova.

Puzzling Decision

With this record of constructive activity behind him subcommittee pattern, it is difficult to understand why Chairman Miller now wants to abandon this representative pattern and adopt only a single subcommittee to handle all of NASA, while assigning two other subcommittees to handle the National Bureau of Standards and the National Science Foundation. Neither of these two organizations has anything approaching the scope or mission of NASA nor do they really require this much attention from the House group.

It may appear that what could be damaged is a minor organizational matter in a House committee in hardly significant in the overall national space program. However, this is the year that the space program is going to face its biggest battle for funds on Capitol Hill. This is the year that NASA will have few spectacular space performances to bolster its support, as did the successful Mercury shots last year. This is the year when it will need a skilful combination of explanatory support from the House space committee, both to the rest of Congress and the trapping public, and critical analysis of many of its less successful programs, aimed at improving their management and convincing the legislature and public that NASA is not recklessly squandering the large sums it accepts. This kind of job is not likely to be done well by a House committee that is devoting only a small portion of its enthusiastic membership to the NASA program. If the House committee handles the NASA bid during this Congress, it will be a setback for the national space program as well as the taxpayers who are relying on this group to function as an alert and intelligent watchdog of its space dollars.

—Robert Elton



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Washington Roundup

Nuclear Policy Quarks

Congressional leaders are starting to express some growing doubts about the Reagan Administration's decision to renege itself to a worrisome standstill between the U.S. and Russia (AVW, Feb. 4, p. 25). First detailed pointer from Congress is likely to be a Republican policy statement attacking this defense strategy.

Rep. Gerald R. Ford, Jr., making Republican defense appropriations subcommittee and a party leader, told *AVIATION WEEK & SPACE TECHNOLOGY* that Defense Secretary Robert S. McNaul's eloquent testimony in closed session has failed to move him about scrapping the nuclear inheritance. As House leaders, including Senator Edward M. Kennedy, have been pushing along the Senate floor on Capitol Hill to reverse their own cuts in defense, McNaul has been pushing for a policy to "raise the bar" on defense.

"We have the full and complete ability to destroy the Soviet Union and win any war before," Rep. Ford said. "But I am still worried about the situation the way it stands now. There is no doubt the Administration believes we have tested the mutual deterrence period now and has exerted sufficient effort to let the problem be a peak ahead with new programs which promise to satiate U.S. appetites."

The Michigan legislator claimed this could be done within the present military budget total by slowing the buildup of conventional forces. The Administration has gone, nevertheless, on conventional forces, which it themselves says will be scaled through to stop Ronald's increase, he said. Rep. Ford attacked the "conservative attack" in the Defense Dept. "I firmly believe we've got the military committee to kill the problem of enhancing our total appetites," he said. "But there's the mental attitude."

NATO Burden Telling

House defense appropriations subcommittee, during closed hearings on the military budget, exposed further inflation with the failure of U.S. allies to pay for some of the cost of defending the West. McNaul was asked to submit a detailed statement showing the contributions of North Atlantic Treaty Organization nations, along with comments on whether they were doing their rightful share. A Senate group headed by Michigan Senator Mike Mansfield traced Europe's growth and issued a report across, warning the U.S. made "the present rough level of our military commitment to Eastern Europe, endangering upon a substantial increase in the western European commitment to NATO."

Army Secretary Caspar W. Weintraub and Comptroller Charles J. Hatch are considered at the forefront of likely successors to Russell L. Gopstein, departing secretary of defense, who will leave his post this summer or fall.

GAO Centaur Probe

Costly progress is being investigated by 14 staffers from the General Accounting Office to determine whether government money was wasted. The report promises to be highly critical of the National Aeronautics and Space Administration and will recommend management reforms at a time when the space agency's budget is facing massive reductions in Congress. The GAO investigation was requested by the House space subcommittee after hearings last year on the NASA-General Dynamics/Aeronautics Centaur project.

Chairman John L. McClellan has given high priority to his Senate investigation subcommittee probe of the F-111 (TFX) fighter fighter contract award which went to the General Dynamics-Grumman team rather than Boeing. He said it will be the first major test this session of members working on the assumption no little change, if open hearings, by now, of the preparation of data involved. This, also, for the broad argument will hold down war with little chance of sentence being able to cut through the thickened underbrush.

Joint Congressional Atomic Energy Committee next month will review Project Vela and other methods of detecting nuclear explosions as part of its analysis of the feasibility of a test ban agreement with Russia.

More Advent Problems

Defense Dept.'s Admire congressional satellite program is in trouble again with Congress. Several lawmakers who have examined the program contend that Admire, as now designed, will not have the specific military equipment which justified its funding and will have lost over all capability that Telstar.

European participation in a world-wide, nonmilitary communications satellite system is being planned by an ad hoc committee representing Belgium, Britain, France, Germany, Italy, Norway, Denmark, Sweden and Switzerland. Comsat will work with the U.S. Communications Satellite Corp. (AVW, Feb. 4, p. 31).

Sen. William Proxmire, who last year denied the accessibility by states for defense contracts, has now announced he had requested "a full-scale investigation" of his state's research and industrial abilities to handle federal defense contracts in order to "help me and other state Wisconsin's case in Washington."

—Washington Staff



⁴²short distance countermovements. Soviet buildings in Crimea before the Soviets began dismantling them (1989) and 518,000 M² when the latter

Recon Photos Reveal Soviet Anti-Aircraft Buildup



Some NADH₁ superoxide reductases are shown fitted with Sidewinder-type electron studies on Colles Santa Clara and Mc. N. unclassified trypsin on some insect (above). Roman 303, Bausch & Lomb inc. photographed during assembly on San Julian's field in Colles. Note visual emulsions and p1 images.



A map of the Caribbean Sea with the island of Cuba to the west and the Yucatan Peninsula to the northwest. The Cayman Islands are located in the center of the map, consisting of Grand Cayman, Little Cayman, and Cayman Brac. The map shows coastlines, major cities, and political boundaries. A small inset map in the bottom left corner shows the location of the Cayman Islands relative to the United States and Mexico.

There is also evidence that certain sites are still in use, and continuing, near the island. Locations of the installations are summarized

in Cuba

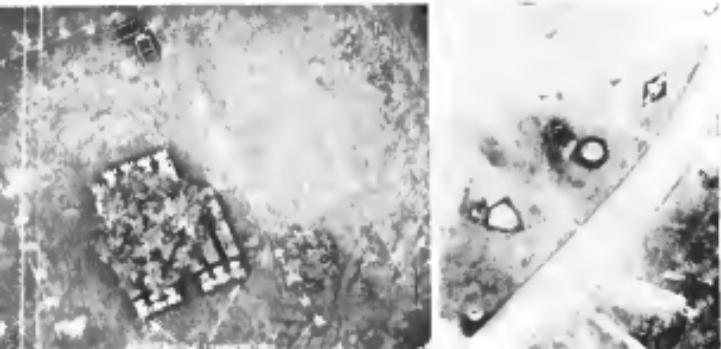


Last leftist MiG-21 Fishbed interceptors is caught above, in flight by US F-105 Thunderchief photo Oct 15 at Suwon, Korea. Note shadow of aircraft on ground and underline of smoke between the shadow itself and its plume.

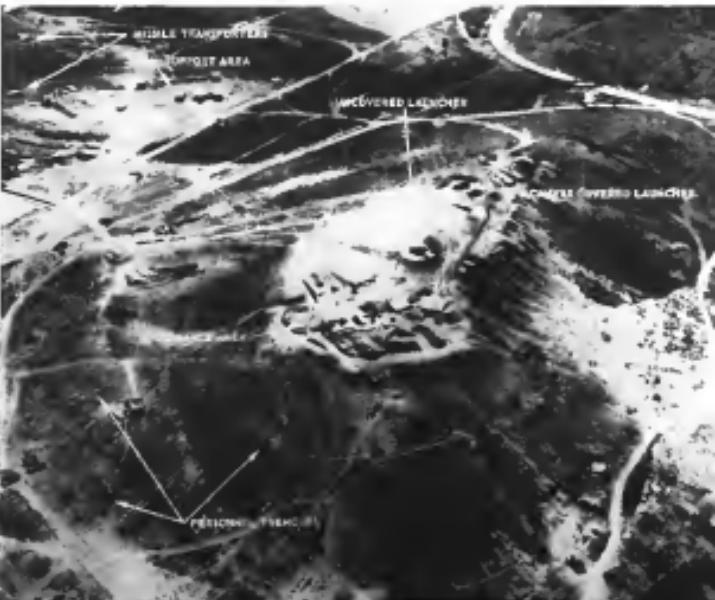




Soviet 82-mm Grad mobile rocket sites are shown above as photographed by a U. S. reconnaissance plane at La Coline on Nov. 18. Note control equipment, launching pads and fire control equipment and an missile firing pads in foreground surrounded by forest area. Mobile TROG missiles are emplaced under a tree near Krasnodar (lower left). Similar to U. S. Honest John, these 21-mm range missiles are used by Soviet troops. Targets of Soviet assumed anti-aircraft ships and anti-aircraft (crane and flag) in Coline are shown (lower right) as these and these patterns outside their headquarters on the outskirts of Krasnodar.



Soviet Komar patrol boats equipped with a pair of missile launchers such as shown at dockside near Gela. Missiles loaded using the Komar-class boats have a range of about 15 mi. and are designed primarily as anti-sweep weapons. Right over Komar boats have been spotted in Gela.



Soviet missile defense missile sites at Saganen on the Isle of Poers is shown as photographed on a low-level pass by U. S. reconnaissance plane. These anti-aircraft missiles are launched from a 30-ft. overhead rail (note center post) and have a range of about 40 mi., and other of these sites have been photographed in Gela at Bari and protecting the approaches to Bari.

U.S. to Select Orbiting Lab or Lunar Base

By Edward H. Kolton

Washington—U.S. will decide within the next year whether a permanent orbiting laboratory or a lunar station will be the next manned space flight program. The decision will be based primarily on the results of a series of studies being conducted by the National Aeronautics and Space Administration and industry (see lead).

Dr. Hugh L. Dryden, deputy NASA administrator, announced the alternative studies would be made at the second NASA Industry Conference, in which 36 NASA contractors had submitted 100 memoranda of problem areas and potential markets. Dryden emphasized that the manned flight program which will follow the Apollo lunar landing will be a revised flight decision and will be designed to meet national needs. Pre-bidney activity leading to hardware development may begin as early as this fall (see lead).

Whichever program is selected will entail companion projects to launch vehicles and supply and resupply spacecraft to be used. These firm vehicles could be derived from the X-13 (Dryden), Gemini or Apollo spacecraft, or entirely new systems.

Dr. Dryden did not reveal a timetable for the pair NASA studies, but he indicated that NASA is making a long-

duration laboratory with sufficient room to conduct scientific experiments. This would,他说, include Gemini and Apollo as space stations, but they could be used as resupply vehicles.

Both Dr. Dryden and Dr. Joseph F. Shea, retired space flight deputy director for science, said that manned planetary expeditions represent another possibility for manned space flight eventually. Dr. Shea and Mrs. Mirella are the most likely choices, but any landing attempt would be made by 1975 or delayed until 1981. Flyby and return missions, however, are possible at much earlier times, he said. Six-year interval landing in 1975 will be characterized by high solar activity.

Dr. Shea, whose office manages studies of advanced manned flight systems, and primary emphasis of the studies is on lunar logistics systems, human factors, space stations and increased planetary cruises. He and two co-signaturees have emerged from logistic studies.

• **Lunar extravehicular module modification.** Known as the LEM mod (AW Feb. 11, p. 36), the concept, the present engine, could be replaced by a larger engine, and a payload of 3,000-6,000 lb. could be landed.

• **Lunar spaceplane launched directly to the moon.** It is a Saturn V vehicle, which could provide a payload of 25-

350-35,000 lb. This would be a two-stage vehicle, using a Rocketdyne J-2 engine to place the spacecraft into a lunar orbit, and another hydrazine-hydrogen propellant descent and landing on the lunar surface.

Shea has up to about seven days on the moon in the Apollo mission, a timetable he is assuming the consumable payload is about 100 lb. per day. She and he said that some type of lunar crawler, with a 200-mile range will require the exploration capability.

The laboratory will be built in the Apollo version, will be equipped with 250 lb. of scientific instruments, and will carry 300 lb. of supplies, expendable film and records back to the orbiting command module.

Studies indicate that a seven-person crew base for 12 days would require an initial supply cache of 340,000 lb., plus 3,500 lb. per month of operation, Dr. Shea said.

A major NASA objective is to establish man's tolerance for extravehicular periods of weightlessness, Dr. Shea said. He said that the first EVA in the current program will be one minute, a 12-month planetary mission. NASA is now studying ways of fixing these initial excursions with Gemini or Apollo spacecraft, but a major uncertainty is whether other offices provide enough room to conduct experiments like weight analysis at bland and noise.

One estimate is that 5,000 cu. ft. will be required, and since this volume is eight times that of the Apollo command module, NASA is now working to go to a larger volume to obtain the data. Dr. Shea and NASA's Langley Research Center has developed a concept for a four-man, 2,500 cu.-ft. station launched unmanned by a Saturn V vehicle. The crew would rendezvous with the station in orbit using Gemini as a ferry vehicle launched by a Titan 2. Resupply would be handled by an Atlas-Agena B.

The NASA-Industry Conference was held not only to the potential market for advanced concepts, but to define the needs of the industry. Dr. Dryden said, "We also try to provide areas where NASA is seeking industry help in solving problems." Peter E. Webb, NASA administrator, and the agency is making certain that single communication do not become dominant in major areas of competition. It was for this reason, he said, that NASA established the Michoud plant as a government installation to help the company that built the plant. Webb said that the company that built the plant will contribute to the continued space program.

Two specific technical improvements are needed in the area:

- **Electromagnetic interference.** Power supplies, communications during voice speech compression techniques, noise-suppression equipment, and house-illumination, and smaller and more reliable type recorders.

- **Thermal insulation.** Heat exchanges and cooling, materials, reliable sensors that can operate at high temperatures (3,000°F.), surface coatings for space craft and spacecraft, techniques for evaluating electronic equipment in space, and orbital control for rocket nozzles.

NASA is requesting that prime contractors seek out superior subcontractors

Re-entry Communications

Washington—New techniques for short-range communications between the re-entering vehicle and ground have demonstrated under simulated reentry conditions by National Aeronautics and Space Administration's Langley Research Center.

Techniques involve using signals from the natural radio field when communications are required. A flight experiment to verify these results is planned soon, according to Dr. Alfred J. Krikor, chief of the electronics and control division.

In previous reentry discussions, requirements of the NASA Langley Communications Research Center, Krikor said, included areas where communications would be required, including tracking stations, location systems and digital transponders. The NASA official said the agency's proposal, using orbital pulse readers with reflective code instruments, suggests that short-range location systems may be superior to infrared systems. Flights with proposed communications are planned during the coming year.

Another area which NASA intends to emphasize is the development of transducers and sensors that provide unique signals in digital format without need for digital conversion devices, Krikor said.

of power performance, "either that will reduce or increase our ability to develop orbital or reentry sources of competence." The prime contractor cannot expect available control skills simply to keep the system within the constraints of a given or given set of requirements.

• **Ground test equipment.** Dr. George M. Low, director of manned spacecraft and flight missions, listed specific problems in married flight for which we would welcome solutions.

He said acceptable solutions have been found in many cases, but that NASA is looking for better solutions. Because of the flight developmental cycle in Gemini and Apollo by now, technical improvements will not be feasible in these systems but will contribute to future advanced space planes.

Low said technical improvements are needed in the area:

- **Electromagnetic interference.** Power supplies, communications during voice speech compression techniques, noise-suppression equipment, and house-illumination, and smaller and more reliable type recorders.

- **Thermal insulation.** Heat exchanges and cooling, materials, reliable sensors that can operate at high temperatures (3,000°F.), surface coatings for space craft and spacecraft, techniques for evaluating electronic equipment in space, and orbital control for rocket nozzles.

- **Structures.** Impact and vibration characteristics of stress, higher elasticity with

adequate to avoid massive problems associated with setting up existing equipment, the agency is studying logic power load systems, and the use of multiple conductors that feed into a single matrix. Both techniques and low-cost propellants are being studied for the multiple combustion applications.

Major problems anticipated for the next generation chemical engines are learning to live with better propellants and to improve high temperature materials to devise fast enough materials to handle high pressure fluids that go to high initial pressures stable at high pressure and how to make the engine cool under the high heat load. Sleepy said.

NASA also is interested in more efficient and cheaper solar cells. Among those under present review are photovoltaic cells made of thin film, he said.

• **Hybrid B.** Target ratings of the NASA-Atomic Power Commission space nuclear program, often called the X-10, are nuclear program, reactor, flight program, design to provide data on the effects of nuclear radiation on hybrid solid heat sinks and on hybrid heat sinks and, eventually, hybridized fiber optics, and the temperature information.

NASA also is looking for hybrid materials as vehicle support equipment, Rover test, and is considering the use of solid state switching devices. Preliminary work exists in recognizing electromagnetic interference and in the improvement of cables and connectors. Use of flat printed cables in hybrid trials to provide higher reliability and reduce costs.

In the area of propellant storage and transfer, NASA is seeking better with casting, casting and disk-like tanks, designs for liquid hydrogen, better propellant storage tanks for high pressure gas methods for transferring propellants in space and tank lifetime in space. Rosen said. Other launch vehicle areas for which industry and NASA selected are hybrid solid propellant boosters and launch pad flame deflection for large vehicles.

• **Ranger Power Supply.** Electro-Optical Systems, Pasadena, has been selected by NASA's Jet Propulsion Laboratory to develop the power supply for the Ranger series of spacecraft 10-14 to be used for simultaneous television surveillance of the moon.

Launch of the entire series is expected to be completed in 1964 and there is a possibility of adding 10 more Rangers for various lunar missions, including launching of a removable solar tapestry containing a television camera housed in the unshielded Ranger 3, 4 and 5 cameras.

Meanwhile, Ranger 6 is scheduled to undergo a destructive testing cycle of 100 FPI for compatibility of possible instruments to Rangers 7-10, for launch that year, and also to undergoing series of Ranger 10-14.

NASA Future Flight Systems Studies

Washington—Definition of future manned space flight systems is provided in a summary of the results of the National Aeronautics and Space Administration studies of future flight systems, the second NASA-Industry Conference, held in the second NASA-Industry Conference.

• **Space station.** Eight separate studies, aimed at defining electrical power systems, design, operation and supply requirements, environmental control and life support requirements and configurations of both landing and resupply stations. Also in the hot air preliminary design and progress definitions for both a two-man and a three-man Apollo resupply vehicle and a Viking-like spacecraft to support a 12-day space station. Final study in this area concerns assembly, maintenance, checkout and repair techniques for launching vehicles from an orbiting station.

• **Vehicle and propulsion studies.** To define advanced nuclear systems, a nuclear orbit-to-orbit ferry vehicle and analysis of post-1970 nuclear vehicles. (See also Leland, based on magnetic annular reactor concepts, liquid fluorine-fueled vehicles employing an insulator breeder, and very large vehicles to deliver a Nova vehicle.) Study and analysis of the development of a nuclear thermal reactor. National Aeronautics and Space Administration has also been invited to take part in the effort to evaluate the Argonne MHD power stage. Studies are also being conducted for the Nova reactor.

• **Lunar base.** Seven studies to define a basic construction effort to support a long-term habitation, post-Apollo lunar transportation system; development of a high-energy chemical orbital launch and supply vehicle; transportation system requirements for a lunar base; power requirements for the base and service vehicle propulsions and data-link engineering requirements for an earth orbital system involving the transportation of the moon.

• **Planetary assistance.** Five studies to assess six option concepts for a manned Mars landing. Requirements for Mars mission, electric propulsive ferry vehicles for the mission, planetary missions, a module model for a planetary transportation system, and concepts to use Mars for early manned expeditions to Mars and Venus.

satellite program, is to have a 196 m dia., and be 1,339 m high. Stage weight will be 130,000 lb., including 150,000 lb. of payload.

Dr. Richard B. Morrison, director of launch vehicles and propulsion in the Space Sciences Office, gave these average cut-off figures for satellites used in scientific programs: Cetus, 511 million, Atlas Agoya, B, 373 million, Thor Agoya, B, 36 million, Thor Delta, 52.5 million, and Scout, 31 million.

Malvin B. Auer, director of space vehicles in the advanced research and technology office, mentioned that NASA is now working on a plan for placing larger satellites. He said the agency is considering an advanced satellite program to determine potential benefits of intermediate size satellites prior to new money.

Auer said that industry may come forward with new results from research into spacecraft concepts for advanced scientific earth-orbiting data and planetary spacecraft. He also mentioned these areas of advanced spacecraft design criteria research.

• **Aerospace instruments.** Atmosphere entry heating, spacecraft configuration and performance, landing and return to Earth vehicle aerodynamics and atmospheric reentry.

• **Environmental factors and aerohydrology.** high energy radiation effects and shielding, reentry environment and impact loads, thermal insulation and temperature control, high vacuum technology and anti-gravity fluid behavior.

• **Structures.** which simultaneously provide strength, stiffness, tolerance to high temperatures and integrity against all manner of loads while remaining reasonably light-weight.

Dr. M. Connelly, deputy director of space sciences, and the challenge to scientists can be categorized in the broad areas of improving reliability, long lead times and schedule slippage, and high costs and cost avoidance.

Charles H. Zimmerman, director of aerodynamics, and the agency's aeronautics capabilities require industry support for aerodynamics in the areas of aerospace and hypersonic advanced propulsion concepts, engine noise, operations research and development of research

Canada Buys Vertical 107s

Canada has ordered 12 V-107 107-tonne-lift helicopters for the Canadian Army. They are similar to 107s now being built for the Royal Canadian Air Force.

The Canadian Army will use them for transport of troops and equipment. The Army designation will be the CH-113A. RCAF versions in the CH-113.

The aircraft's tandem rotor is powered by two General Electric T700-GE-401

engines to aid in the study of all-weather capabilities and cargo deployment.

In the hypersonic cruise vehicle area (AW Feb. 11, p. 76), Zimmerman said NASA's initial work indicates that reentry vehicles appear promising, at least up to Mach 10 to 12. Research items now pending from Mach 5 to initial Mach 25-30 are: (1) Supersonic-bombing ranges are referred to the Mach 25-30 velocity range, and reentry ranges up to Mach 8.

A. M. Auer, acting chief of communications satellite technology, said the agency needs to develop a reliability analysis technique, frame analysis, error correction techniques, error methods, power stabilization techniques and power structure with regard to satellite characteristics and frequency of vibration. The agency also plans detailed studies to determine which of the communication satellite systems are cheapest and most reliable.

In summary, NASA will study all-electric beam shaping and steering techniques, Andrus said. In summary, the agency will develop a communications system for the first time that will be explored. Spacecraft systems will be studied to isolate the present typical 12-14 dB noise level, and improvement of ground receiver bandwidth at playback systems beyond the 3 dB level also is sought.

William K. Widger, a chief of operational meteorological satellites, said the substantial market in weather satellites does not lie in completely new and different spacecraft from Tiros and Nimbus, but rather in general improvements in those areas.

• **Support networks.** to develop such systems as range orbition centers, which take pictures of clouds at angles, high-resolution electrostatic tape recorders with more efficient storage, improved infrared and radiation detectors, error recovery systems which operate in the space, picture memory and radio, speech, tape recorder, control, power, recording and recorded subsystems.

• **Sensor systems.** improvements for atmospheric cloud, atmospheric and solar ultraviolet, ultraviolet, thermal, ionosphere, winds, pressure, density, precipitation, sea, surface circulation, index of refraction and altitudes of significant atmospheric layers.

• **Improved data handling, storage, retransmission and related equipment.** Dr. Widger said several special instruments will be carried on future Tiros research spacecraft. Among them will be a 15-micron ultraviolet to provide data for Studies horizon sensor development, ultraviolet particle mass spectrometer, to provide particle flow rates and related data in the polar ion traps and cameras to view the earth disk. Four 500-kilowatt solar cells and three solar cells with 22,500 m² pergen-

Syncom Launch

Cape Canaveral—Ground tracking stations lost contact with the Syncom 2 communications satellite, Feb. 13, during the spacecraft's transfer from an elliptical to a geosynchronous orbit.

National Aerospace and Space Administration believes that the satellite's spin axis may have been misaligned during the firing of the 90th stage, Feb. 13, in the Tiangong solar-perturbed state. The state, monitored from the Hughes Aircraft Co.-built spacecraft, was fired at 9:42 a.m. EST, was after launch of Syncom 2 from Cape Canaveral. Ground tracking stations determined that all telemetry and beacon signals had ceased. The satellite (AW Feb. 14, p. 64) failed to obey all ground station commands. NASA said that it would continue to make attempts to reestablish contact with the satellite.

Syncom 2 had been launched at 12:50 a.m. EST, Feb. 14 by a three-stage Delta vehicle.

Expansion of NASA Tracking Net Planned

Washington—National Aerospace and Space Administration's \$149 million Fiscal 1964 budget request for expansion and improvement of its world-wide tracking and data acquisition network—double the amount appropriated for the same purpose this year—is intended to meet the needs of the Gemini and early Apollo orbital missions. Major improvements include:

• **Mercury orbital flight network.** New ground station will be installed at Coonawarra, a suburb of Australia, to handle valuable orbital information planned for Gemini returns. This station, plus seven others in the network, will be orbited with pulse code modulation (PCM) telemetry, new acquisition antennas and digital computer systems. New earth-based stations will be installed at these eight locations.

• **Deep space network.** will have 35-ft-dia. antennas installed in Australia and in Southeast Range, providing two such antennas at 120-day cyclical longitude around the globe so that more than one deep space probe can be tracked at one time. A 210-ft dia. dish antenna will be installed at NASA's Goldstone, Calif., facility, the first of three planned for a global network.

• **Earth satellite network.** Aerospace tracking stations with diameter of 40 ft will be installed in Chile, Peru and South Africa, and 15-ft antennas will go in Australia, Chile, New Zealand and North Carolina to enable the network to handle large amounts of data expected from orbiting astronomical and geophysical observatories.



High resolution photos are just part of the reconnaissance job. Fairchild Stratos also will be used in precisely to geography and numerous other critical conditions that surround surveillance from high-performance aircraft. Through this watch, the whole moon story begins to take shape. To handle the important job of high-speed data acquisition in flight, Fairchild Stratos has developed compact, light-weight computers and display devices which provide permanent data

records as each image is easily read alphanumeric format. When coupled to Fairchild Stratos data links, the "whole moon story" can be rapidly viewed in "real time." High speed annulation techniques are but one outgrowth of the years of experience that have made Fairchild Stratos the leading supplier of equipment for reconnaissance and surveillance needs. For more information, contact our Director of Customer Relations.

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COMPASSIONATE HUNTER

For a long time, the Albatros Sea was the pilots' bane in the Austro-Hungarian fleet. Then, in the Fall of 1916, Alfred Konopsek's crew created a way to neutralize the enemy shipping. And the Central Powers were powerless against them.

In an aptly named move, the first set up a seaplane station at Kammer, Austria. On September 15, 1916, their plan paid off. On that day, a submarine was spotted off the coast of Cattaro, Austria, sailing 70 feet below the surface on a Northwest course. The Kammer station was immediately alerted and two seaplanes took off on the hunt.

One Austrian Loafer Flying Boat was piloted by Sub-Lieutenant Walter Zeleny, the other by his commander, Lieutenant Konopsek. Each seaplane had one observer.

Zeleny's biplane had a six-cylinder, watercooled, 160 HP engine and a maximum speed of 82 MPH. It carried two 116-pound depth charges and four 25-pound bombs. The depth charges were set to explode 30 feet below the sea's surface. The shadowy prey Zeleny and Konopsek were hunting was a French Leafron type called the Foucault. She displaced about 480 tons on the water, 550 tons submerged. Just over 167 feet

long, she cruised at 15 knots up, 12 knots under, and carried six 15-inch torpedoes in external launching rigs.

Zeleny flew to the area where the Foucault was last sighted. After a half hour of circling around, his observer, Baron von Kuschlag, spotted the target. Zeleny dove his seaplane down to 600 feet, pulled out right above the unsuspecting sub, aimed carefully, and dropped his depth charge.

Both charges exploded 20 feet in starboard of the Foucault—one at the surface of the sea. When the sub crested down a bit, Zeleny circled back to find the telltale signs of sinking. The Foucault was gone. Only a few patches of oil skinned the sea. His crew were he had missed.

But he was dead wrong. The two depth charges wounded the long fish just as the first ring of an asp's tail. The Foucault's two officers and 27 crew men thought they had cracked a mine. Water gushed into the hull. She rolled to one side and sank quickly with the deep.

The Foucault didn't know how deep. The depth gauge showed 250 feet—low as it could show. The outside pressure was unbearable. The hatches began to give off their ancient names. The men moaned in pain. Then after 30 minutes, the hand on the gauge moved. From 250 feet to 280 to 300...180...50...10...6...9...8...7...1...2...3...200! The dive rite pumps had miraculously flooded the Foucault out of her watery crypt.

As the submarine shuddered up from the sea, her commander ordered the crew to abandon ship. He shook each man's hand as one by one they descended to the narrow deck. Two-by-two men stood on the deck wounded. Zeleny, who had the final wounded Foucault, also lost his life in the confusion of the sea.

Suddenly, two seaplanes appeared in the sky. Zeleny and Konopsek were as surprised to see the sub as the crew was surprised to see them.

The 1st Officer opened up on Zeleny's flying machine with a small deck machine gun. Zeleny returned the fire with a small hand torch that exploded and swept some of the crew into the sea. Then the Foucault sank, raising her bow in the sky and disappearing.

Thrilled with victory, Zeleny and Konopsek landed their seaplanes and floated into the midst of the frightened sailors. They pulled the wet, cold crewmen into their float boats and hauled. Every single man was saved.

Soon an Austrian torpedo boat arrived

on the scene and took the 27 crewmen prisoner. The two seaplanes, each with six Albatros 170 HP field engines, returned triumphantly to Kammer.

Zeleny received many decorations and letters of congratulations. The one his commanding officer had was a letter from his father who wrote:

"I am very pleased with your success, especially as no member will cry following the sinking of the French submarine and your rescue of all the crew."

Amico.

There were some good pilots on the other side, too.

Yes, they and the pilots on our side contributed much to the growth of the world's aerospace industry. Of course, they couldn't even imagine today's sophisticated equipment.

What is Leach doing in today's space age?

More things. For example, they are a leader in the miniature relay market. The 1st Officer Repeater/Relay is now on many U.S. satellites. It withstands launch, reentry, and reentry belts...plus heat when and where it's needed.

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Apollo-Saturn Crawler Due in Late 1964

Cape Canaveral-Air Force Base and State of Florida will work in the National Aeronautics and Space Administration to design and manufacture the mobile transporters (AW Feb. 4, p. 26) which will transfer the completed assembled Apollo-Saturn vehicles from S-400's in mobile areas to the launch pads.

Mobile which will transport a complete assembly from mobile areas to launch pads will be one of two components in mobile base for the crawler. Bausch Erie Co. of Milwaukee, Wis., was the subcontractor. Transporter base had been made by NASA to bid (AW Dec. 26, p. 21). Present NASA plans call for manufacture of two crawler, expected to cost between \$4 and \$5 million each. First vehicle will be delivered for testing in 1964.

Crawler will be mounted on a platform about 130 ft long, 115 ft wide and 29 ft tall and we go along about 5.5 mph. It is 12.5-cubic-yards of steel and will be four-wheel drive. It will be able to drive a pair of steel track caterpillar tracks. The height of the tracks will be powered by two 2,600 hp Diesel generators. Platforms will rest on the crawler and two hydraulic cylinders located on each track.

In another Apollo developer, Bausch Erie has won a \$15-million contract to provide technical support, hardware, computers and ground equipment for Massachusetts Institute of Technology for the Apollo system.

Soviets Ask Pullback

Soviets last week urged what appeared to be a move to the firm's advantage of the current world Western Europe that the U.S. Army is likely to plan some form of nuclear disengagement at the recommended 17-month deadline, Soviet First Deputy Foreign Minister Vasilii Kozhukhov proposed that the nuclear powers:

- ...disarm the longest lines for submarine delivery, nuclear and nuclear weapons and...remove the use of strategic bombers for nuclear disengagement.
- ...reduce the number of long-range bombers by 20 percent within three years, starting with nuclear bombers.
- ...downsize strategic nuclear missile forces, long-range bombers and nuclear bombers of 1,000-km range and over, and the similar weapons to fit them with...to their annual reduction.

- ...withdraw the strategic missiles designed for delivering nuclear bombs to targets as well as those nuclear bombs from strategic bases to within their own boundaries."

House Unit to Probe NASA Fund Shifts

By Alfred P. Akbarro

Washington—House space committee is to lead an investigation into NASA's reprogramming of funds. The agency has reprogrammed more than \$123 million within the past few months for cancellation of facilities. The reprogrammed funds came from a fleet of infrared construction projects and research and development programs.

Chairman George Miller (D-Calif.) and Rep. Joseph Barth (D-Minn.) chairman of the space subcommittee, expressed growing concern over NASA's reprogramming of funds.

Since last fall, NASA has made over \$100 million in fund transfers involving well over \$100 million. It is the large number of transfers and the large amount of money that brought the committee to the attention of committee members.

Most of the reprogramming activities in Congress by NASA deal with transfer of research and development funds to construction activities. Other types of transfers—reprogramming of research and development monies from project to project within a program—do not require such notifications. For instance, the \$123 million in funds that had been apportioned for infrared flight programs may be shifted from Project Missouri to Grissom or Apollo without notification to Congress. This kind of reprogramming also will not be quantified by committee members.

These are the large reprogramming actions taken this year, and the parameters for which the funds were transferred.

Gemini Planning Unit

Washington—Defense Dept.-National Aeronautics and Space Administration Gemini Planning Unit has been established to oversee the reprogramming of funds from both agency and congressional planning, operational flights and in-flight tests and analyses and dissemination of flight results.

Co-chairs of the board are Dr. Broadway McMillan, assistant Air Force Secretary for Research and Development, and Dr. Robert C. Stennis, Jr., associate NASA administrator. Defense members are Dr. D. L. Krause, special assistant for space affairs of defense research and engineering, and Gen. George S. Brown, commander of Air Force Systems Command. NASA members are Robert W. F. Brown, director associate administrator for defense affairs, and Russell Holmes, director of advanced space flight.

• **Manned Control Center at Manned Spacecraft Center, Houston—\$16.9 million.**

• **Systems S-80 stage test facilities at Sacramento and Santa Susana—\$16.5 million.**

• **Apollo spaceflight development facilities at North American Aviation, Inc., Downey, Calif.—\$7.6 million.**

• **New test facilities and modification of existing facilities at White Sands, N.M.—\$10.4 million.**

• **Systems S-2 stage test facilities at Downey and Santa Susana, Calif.—\$11.2 million.**

• **Engine test stand at the Nuclear Rocket Development Station, New Mexico—\$7.3 million.**

• **Construction of Highway No. 95 connecting the Nuclear Rocket Development Station—\$4.5 million.**

• **Mississippi Test Facility, Saturn vehicle development center—\$14.3 million.**

• **Wind tunnel facility No. 34 and 37 at the Atlanta Marine Range—\$2.6 million.**

• **Modifications to engineering, fabrication and other major McDonnell Douglas plant, New Orleans—\$18 million.**

• **Metastable radar facility at the Atlanta Marine Range—\$1.7 million.**

• **Construction of all facilities in and near Merritt Island at AMR—\$2.2 million.**

• **Tracking station in northwest Arizona—\$2 million.**

Major transfers in the latter part of 1965 included

• **University research facilities—\$5.4 million.**

• **Applied Science Laboratory at the Goddard Space Flight Center—\$1 million.**

• **Space Shuttle facilities—\$1.5 million.**

• **Systems G-5 test stand—\$2.2 million.**

Chairman Miller has requested more comment on the reprogramming of funds by NASA than on the men the committee will investigate.

"We want to know who the money wasn't spent for the purpose the NASA people had it was going to be used for," he said. "The not saving funds are being measured or counted. But we are setting the money aside and paying into the NASA program, so we are going to have to be measured that it is being managed properly."

Ten days ago, Rep. Olin E. Teague, (D-Tex.), chairman of the manned space flight subcommittee, Rep. Barth and other members of the investigation visited the Manned Spacecraft Center at Houston.

"We had a rundown on what funds had been authorized as the manned flight program and asked about actual expenditures of funds," said Rep. Barth. "We found that there were more than \$123 million in transfers made within the past few months for cancellation of facilities. The reprogrammed funds came from a fleet of infrared construction projects and research and development programs."

"I could understand it then, when programs were not well-defined," he said. "But they have been in programs more than five years and these programs are pretty well set. We should be able to expect better management."

NASA has been reorganizing as sharply. The Space Act, as amended in 1961, permits the agency to spend 15% of funds appropriated for salaries and expenses and 10% of funds appropriated for construction and maintenance for construction of facilities.

In addition, the act permits the agency to transfer without restriction monies appropriated for research and development to use for construction of research and development facilities. However, research and development funds may not be used to acquire land.

Other provisions of the act permit NASA to use up to \$30 million appropriated for specific construction projects to construct, expand, or modify facilities, or to other organizations at no less than 10%.

NASA's authorization covered unanimous approval at the House last year. Funds largely in the way of work of members of the House space committee and public enthusiasm generated by the Mercury-Atlas-8 flight. Key members of the committee said that an indication of poor management on NASA's part could damage that support.

Rep. Barth said he was sympathetic with the need for reprogramming of funds in NASA's early years.

COIN Agreement

Washington—Navy and the Office of the Secretary of Defense proposed test agreement last week on how to prevent the missile company (COMINT) aircraft program (AW Feb. 11, p. 93). An agreement is reached this week, reports say, for proposals as expected to be sent to the Senate about April 4.

Present plan is to build three prototypes, one fibreglass fuselage and two from aluminum alloys. It will be programmed for considerable endurance so that the aircraft will be able to intercept at the place of final impact.

The \$700,000 award would be given to two 375-hp. turboprop engines, for a total of 1,350 hp. for the entire aircraft, instead of 1,150 hp. for each engine as originally reported (AW Feb. 26, p. 15).

The contractor's office has maintained that speed is necessary in developing and producing an aircraft as fast as by natural forces of such countries as South Vietnam. The Navy's view has been that a logical development order should be followed. The compromise agreement will be signed by the Navy and COMINT, the Army and the Air Force, and the Army's flight laboratory, the Defense Systems Evaluation Board, in which three contractors are building prototypes before a final decision is reached.

"I could understand it then, when programs were not well-defined," he said. "But they have been in programs more than five years and these programs are pretty well set. We should be able to expect better management."

NASA has been reorganizing as sharply. The Space Act, as amended in 1961, permits the agency to spend 15% of funds appropriated for salaries and expenses and 10% of funds appropriated for construction and maintenance for construction of facilities.

In addition, the act permits the agency to transfer without restriction monies appropriated for research and development to use for construction of research and development facilities. However, research and development funds may not be used to acquire land.

Other provisions of the act permit NASA to use up to \$30 million appropriated for specific construction projects to construct, expand, or modify facilities, or to other organizations at no less than 10%.

House space committee will have "joint" hearings on about a week. Because of these hearings is to find out where the U.S. stands in space science, what has been accomplished in the last year and where programs have stopped.

Chairman Miller and NASA's subcommittee hearings would be handled by three subcommittees instead of four. The subcommittee on advanced research and technology, headed last year by Rep. Viekie Andrus, will be eliminated and the two it covered will be headed by Rep. Joseph Barth (D-Calif.) and Rep. George H. Mahon (D-Tex.). The subcommittee on flight operations and Rep. Ken Hechler (W-Vt.) will be headed by Rep. Ken Hechler's subcommittee on applications, tracking and data separation.

Rep. Miller has indicated to committee members that after the subcommittee hearings, the three subcommittees in NASA will be formed into a single subcommittee for that agency. This process would mean committee members who feel that a single subcommittee would be less effective in examining problems will be given a chance.

The present plan is to have a single subcommittee for the space program.

Some committee members also would like more scientific, engineering and technical committee on the staff. Thus far, if the committee does not do a more vigorous job in examining NASA's budget requests, other committee, such as the House committee on government operations, would do so.

Since which the House space committee will assume more closely would include the AF-1 combustion instability problem (AW Feb. 4, p. 26), and the decision to accomplish a launch, leading on the space late in the decade using the large orbital rendezvous technique after the earth orbiting weather station is launched (AW Jan. 23, p. 20).

U.S.-Soviet Agreement Possible On War Definition, Enthoven Says

Washington—U.S. and Russian agreement on the difference between nuclear and non-nuclear war is possible, according to Dr. Alvin Enthoven, deputy acting secretary of defense for systems analysis.

"There is and will remain an important distinction, a 'fog break' if you like, a reasonable qualitative distinction that both constituents can agree upon and agree upon, if they want to agree upon it," he said.

In a lengthy speech closed with high-level Administration officials delivered to the Los Angeles University Forum on National Affairs in Los Angeles Feb. 3, Dr. Enthoven made a penetrating examination of U.S. weapons policy.

In the nuclear age, the constituents will have a very powerful incentive to agree upon this. An enemy, however, can easily exploit a reasonably non-negotiable limitation on weapons other than "hot" in a threat of nuclear war, he said.

"Nuclear war can and must be avoided."

Dr. Enthoven pointed out that the President has many instruments he can use to maintain the U.S. program in international affairs. In addition to military force, there are diplomacy, economic policy, foreign economic and military assistance, alliances and other activities that contribute to national interests.

In preparing the buildup of conventional forces, he said, "There are circumstances in which the use of nuclear weapons would be inappropriate. For the same reasons that a slogan however does not make a good headline, nuclear weapons are not a good substitute for non-nuclear forces against a wide range of military threats. Even if they could be used to satisfy the immediate threat, they would be required to achieve our objectives, they would risk triggering escalation, they would be an unnecessary destruction of life."

Dr. Enthoven also told defense legal to Chairman George H. Mahon, "The use of force in disputes can not just be patible under certain conditions, among the following: first, the use of force here has a reasonable chance of success; second, if successful, it may not add a further irritation than the one that would prevail in the absence of the use of force; third, the force that is used must be proportional to the object being sought in the conflict being presented."

Because nuclear war is so destructive, the use of nuclear weapons must be reserved only for the most desperate circumstances. But if the nucleus has to be resorted to, the use of the with the strength of conventional forces in likely to be able to lose it was on at most less than 10%. The rule without adequate conventional forces will have 90 years for effective resistance to make eradication."

Long-Endurance, Subsonic Aircraft Studies Are Revived by Air Force

By Larry Boada

Washington—Air Force has revived studies of a long-endurance subsonic aircraft that could act as an aerial early warning post, ballistic missile detector, long-range anti-air missile launcher or electronic intelligence and electronic countermeasures aircraft.

The studies are now being carried out under the name "Dromedary." In the late 1950s a similar program was carried through the study phase under the name CAMAL (Comprehensive aerial missile launches and low-levels), utilizing nuclear power for propulsion. That program, postponed to the point where approval was sought for construction of two nuclear-powered prototypes, but a proposal was denied.

As now proposed, the Dromedary aircraft would be able to fly long distances, carry advanced weapons, while fuel consumption would be lower than that of any aircraft. Efficiency would be further enhanced by extensive use of heat-recovery devices to recuperate heat energy lost in engine cooling.

Dromedary would have an endurance of 120 hours if uncatalyzed. It would have at least two crews to alternate watches. It would be bigger than present-day aircraft such as the B-52, and could operate from much smaller runways.

Air Force officers are somewhat optimistic about the Dromedary because the studies were not discontinued. In the past two years the Office of the Secretary of Defense has put the lid on many Air Force studies. The Force has been prevented to revitalize Dromedary with modest funding, but there has been no overt encouragement.

Defense officials like the idea because it offers a variety of ways to use the aircraft, especially as an airborne command post. Defense Secretary Robert S. McNamara has authorized the need for a long-endurance aircraft to act as a nuclear attack, intelligence, airborne ports, ships at sea, submarine and anti-satellite post. At present, Strategic Air Command B-52C-35 aircraft are its constituents. A chronic shortcoming of current defense studies experts says, are too expensive to operate as intended posts, from the standpoint of fuel cost, maintenance and overhead. In addition, they cannot remain airborne for a long period of time without refueling.

An unclassified ballistic missile launching platform, these Defense Dept. studies say, Dromedary is much more attractive than the B-52 because it is expected to operate.

Now that the B-52-based Skylift

has been canceled, the Air Force is looking for ways to keep long-endurance aircraft in nuclear deterrent forces. Dromedary may be the answer.

In addition to launching ballistic missiles, Dromedary would be able to defend itself from aerial attack with anti-air missiles of extended range. In the event of a nuclear strike, the Dromedary would have detected the first aerial attack, with 200 nm flight range.

But the Dromedary would be as much more valuable than the Minotaur that it has a good chance of approval for development.

As a half-life missile launcher, Dromedary would operate at altitudes where the engines would be most efficient. As an electronic countermeasures and electronic intelligence aircraft, it would be able to fly higher to intercept jamming signals. It would have the range to intercept the communications between launching and receiving a greater payload, and the capability toague three or more items in mere hours per year. Attrite capabilities would have bases the same. Dromedary would have one word.

Nothing says, has done considerable work on boundary layer control (BLIC), which would be one of the key parts of the Dromedary concept.

Northrop studies and applied research represent a jump ahead in principles being adopted.

The Dromedary's unique possibilities: Regeneration is one way to keep development that permits dramatically lowered specific fuel consumption—from 3.5 lb/spl ft-lb to 0.8 lb/spl ft-lb. Both Allison and Pratt & Whitney have tried methods in which the engine is cooled in a rotating duct, which sets in a heat exchanger to prevent the air going into the engine. Curtis-Wright uses a liquid metal heat exchanger.

In a variation of this, Allison's engineers are using the exhaust gases, which still heat a partial mixture of exhaust oxygen, and feeds them back through the engine inlet, raising the temperature of the inlet air.

All of these getups, which are of no value to turbines or turbines, permit the specific fuel consumption to remain about the same regardless of altitude.

Air Force officers say that if approval

was given to build Dromedary prototypes after a definition phase, development time would be about three years.

Midas Reduced to Experimental Status

Washington—Midas early warning utility, originally scheduled to become operational by 1964, has been reduced to the status of an experimental program after because of severe problems that have caused doubts as to its basic feasibility.

This is the second of three early Air Force military satellite programs to be canceled because of technological problem. Several months ago USAF reluctantly proposed a drastic cutback as its satellite successor Sats program.

Troubles with the Midas virus from an early-orchestrated program schedule which did not prevent efficient construction of high-growth infrared portions of the earth against which IRCM radar echo had to be detected, and then evenly complex satellite designs that caused frequent malfunctions in orbit (AW Sept. 24, p. 50).

From Research and Engineering, opposed the plan, using that a militarily useful satellite would have to be superior. General A. Quisenberry, then Deputy Director of Defense, added to the Air Force's justifications by May 6, 1959, when actually signing the formal document approving the project. Subsequent moves by Defense Dept. officials stalled the program and it was dropped along with the ANP program in 1961.

Two components, in addition to Camar (Joint General Directorate/Caravel) have been identified with the post and current status. Lockheed Aircraft Corp. continues the CAMAL as its effort to build the much larger than a CAMS SAC aircraft, but it has the range SAC to reach the upper hemisphere to intercept the communications between launching and receiving a greater payload, and the capability toague three or more items in mere hours per year. Attrite capabilities would have bases the same. Dromedary would have one word.

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was given to build Dromedary prototypes after a definition phase, development time would be about three years.

France Puts New Strain on NATO But Is Expected to Aid Arms Output

By Carl Brewster

The U.S. another official adds, also has not yet placed its strategic card in its efforts to penetrate France to play a greater role there, but a defense role for France NATO is, he believes, the American guarantee of a strategic alliance protection of western Europe, a being brought to a head in France policies to cut national plans with that resultant strain upon the alliance.

Nonetheless, on the defense as a result of the vacuum of its role of Great Britain as a Common Market partner and as a partner of the U.S. proposed multilateral nuclear force (MN), France is becoming more bitter toward U.S. Johnson's government. NATO and the European Defense Community, and France, NATO, other officials generally agree that Johnson's current effort to renew or severely deepen American influence in western Europe, partially as an offshoot of its desire of creating a third force to combatbalance the U.S. and USSR.

French working closely with the problem, however, believe that France's effort will continue to work with NATO while cooperation can coexist with its own interests.

Despite the virtual character of NATO as a spousal force to some top officials, the French believe that France will maintain its own military forces for the defense of Southern France, and that the alliance, before long, will be a nuclear alliance. French spokesman concur that the Rhenish Block will eventually make another project already under way.

Neither France expected to put out of existence plan for a NATO production program for the General Dynamics/Plessey Radar industry, which is defense missile or a projected multilateral project for an advanced anti-air missile system.

Others, however, believe that France's decision to push U.S. interests into the Common Market as far as possible and control, within France—U.S. has in effect, effect upon the overall objectives of American and European defense departments to the contrary (AW Feb. 11, p. 79).

One optimistic view is the fact that France apparently has refused that from attempting to pressure other European allies with which it has influence to follow its lead and renounce the U.S. nuclear plan.

"Partly, we may say that France made our official and 'and went the other way,' an odd indication that they are completely ready to get out of NATO."

commitment, they add, for the second French. Other spokesman does that unless the Turkish in the Iberian goes into effect, committed over are, threatened loss of deterrence. A greater immediate worry, they say, is the number of local employees who will lose their jobs—about 3,000 in total.

One possible reason for France's present stand over U.S. interest is the fact, as noted, that some spokesman, that it could not be made nuclear force only if France were made able to attack or penetrate, and penetrate, the rest of me."

Planned force of 50 Minge 4 radar sonic boomer and other nuclear-equipped aircraft will have main objective—to provide a nuclear deterrent capable, if necessary, of destroying up to the Soviet Union's defense of the Common Market, it is hoped that the concept of France is not worth such an expenditure to the leaders of the Soviet Union.

News Digest

France Air Force of Space last week received seven new MiG-21s. The Matra-Baecon Cis aircraft. Service will be conducted on a four-month basis. This new step was discontinued last October during the Colon conflict.

Air Force was scheduled to break ground last week in a formal ceremony at Cape Canaveral for the initial steps in construction of the Titan 3, later named Thoros Launch Facility (TLF).

Navy Lockheed Polaris A-3K missile was successfully launched from a land pad at Cape Canaveral. The Polaris II flight was the second consecutive success for this 1,000-mi range missile.

British Hawker P.1127 made the first vertical jet aircraft takeoff and landing at an altitude of 100 ft. Flight was conducted by the HMS Ark Royal in the English Channel.

Space Technology Laboratories was selected by Air Force's Space Systems Division, worth to apply the space-ground communications technique which it to form the basis of the future Air Force communication system for remote-sensing types of military satellites worldwide (AW Sept. 10, p. 76).

NASA has selected Saturn diagnostic. Saturn I, which was known as S-1, C-1B is known as Saturn IB, and the C-5 is called Saturn 5.

Northwest Airlines flight 707-200B crashed 7 mi. after taking from Miami, Fla., Feb. 13, killing all 43 persons aboard.

Trunkline 1962 Profit May Top \$25 Million

Early reports indicate figure could reach \$27.5 million, compared with loss of \$34 million in 1961.

Washington—First financial reports for 1962 indicate that most trunkline carriers will show a substantial improvement in net earnings for the year, and that the industry will surpass the \$25 million net profit forecast by AVIATION WEEK & SPACE TECHNOLOGY (New 18, p. 40).

Cheswick says: "Early reports for 1962 indicate that the industry will report a net profit of approximately \$27.5 million for 1962, compared with a net loss of \$34 million in 1961. At the same time, Pan American World Airways, which is not included in the midline compilation, has reported a net income of \$14.5 million for the year, a 62.6% increase over the net profit of \$8.9 million reported in 1961."

Three carriers—Eastern, Northwest and Trans World Airlines—will show losses for 1962, but the total deficit of the three will be considerably less than their total losses in 1961. TWA, for example, is expected to earn in 1962 \$1.7 million, up from \$1.4 million in 1961.

Bogart says: "We will be shown to Delta Air Lines. With an increase totaling close to \$150 million at the result of increased traffic volume generated by its recently acquired Southern transcontinental route, Delta will show net earnings of about \$15.1 million for the 1962 calendar year. Delta reports formally to its stockholders in their annual report."

National, which also reports on a fiscal year ending June 10, has hopefully reported a \$1-million net profit for the first six months of fiscal 1962, compared with a net income of \$27.110 in the same six months of the preceding year. It is expected from Civil Aeronautics Board Room 40s that Net

British Airways 1962 net earnings

Air Union Revision Circulated

Final-Revised version of the Air Union charter agreement drafted by the French government is now being circulated on a diplomatic level among the other nations concerned—West Germany, Italy and Belgium.

Cheswick, incorporated before the French government gave formal approval for Air France's entry into the consortium, was instructed at once that his reportedly confidential provisions for the purchase of common equity on the part of the three countries

France, it is believed, keep the provisions of the agreement dealing with the purchase of common equity overruled as the other three countries involved—Belgium, West Germany, Austria, Italy and Salzburg-Belgium World Airlines. It is a long step, however, for Air France to sell the Salzburg-Austria-Airbus Corp. 50% 12.5% revenue interest, but French law often makes such a long road to day producers in order to buy a fair, long-range American or cost when and if it appears.

Meanwhile, KLM Royal Dutch Airlines' application for re-entry into Air Union is not expected to be seriously considered until a final draft of the charter agreement can be approved by the four present members, and officials here agree that this could be a lengthy process.

were \$2.4 million, equal to \$2 cents per share, an increase of 90% over the \$1.2 million and 49 cents per share in 1961. Included in the 1962 net profit was a net profit of \$234,000 resulting from the application of investment credit provisions of the 1962 Revenue Act.

British total revenues reached \$94.5 million, an increase of 6% over 1961 revenues. Gross expense totaled \$90.1 million, a slight 1.7% increase over 1961's expense level. Freight operating income was \$8.1 million.

A 1962 net profit of \$1.7 million has been reported by Continental Air Lines on gross sales of \$86.2 million. Total operating expenses for 1962 totaled \$81.1 million, increasing with \$53 million in 1961. Operating income for the year was \$5.1 million.

In announcing year end results, Continental says its break-even load factor now stands at 47.2%, a marked drop from the 43.2% for 1961 and the lowest in the airline industry. During the last six months of 1962, National reduced its break-even load factor from 45% to 45%.

United Air Lines has reported a net profit of \$7.7 million for 1962, upfolding a \$1.3 million gain from the sale of United Air Lines of Canada. Total expenses for 1962 were \$47.6 million, compared with \$41.4 million the previous year. Revenue passenger miles increased 8% in 1962 compared with 1961.

Eastern's expenses totaled \$93.7 million for 1962, an increase of 10% over the \$83.3 million for 1961. Total expenses for 1962 were \$47.6 million, compared with \$34.4 million the previous year. Revenue passenger miles increased 8% in 1962 compared with 1961.

British Airways 1962 net earnings

According to information developed by AVIATION WEEK & SPACE TECHNOLOGY from the Civil Aviation Authority Room 40s, United Air Lines will show an increase in revenues from \$517 million in 1961 to \$563 million last year. Under the same formula, Western Air Lines, which as of late last week had stated no public opinion, will show a net profit of \$3.3 million.

Figures shown from the CAB Room 41s, however, are subject to drastic revision since accounting procedures required by the CAB are much more than those used in reports to stockholders. Such bookkeeping adjustments as tax write-offs and depreciation are treated differently under CAB standards than under generally-accepted accounting procedures.

Northwest Airlines will report a net profit of \$3.2 million on gross revenues of \$153 million. The airline's net earnings for 1961 were \$3.6 million.

Pan American 1962 revenues were \$63.4 million for 1962, the first time in the company's history that revenues have exceeded the \$500 million mark. Actuals to the revenue for 1961 are estimated to stand, to be an excess of approximately 500,000 dollars to earnings.

Continental Air Lines cut 40.1 cents at 1961, a reflection of increased devaluation of jet equipment. Passenger revenues increased 9.4% over 1960 and freight revenues rose 12.3%.

TWA's net profit will be reported by the eighth conclusion with net earnings in 1962 as expected to reach \$4.9 million. All figures are intended to be, but the actual results are not expected to vary in any great degree. The estimated loss of \$22.7 million in the third remaining carrier is, however, subject to adjustment. Last winter's bookkeeping changes could improve the figure and the final two figures also include the same \$2.7 million in revised net funds received by Eastern as a result of the right-of-way acquisition in 1962. This amount is subject to final audit of the contributing carriers.

Pan Am—Brazil—Continental Delta, National and Northwest—which round violent objections to statements by American and Eastern that the industry is "weak" (AW Dec. 14, p. 40) equated a total net profit of \$4.7 million for 1962. This is half that amount, however, as represented by Delta's \$11.3 million profit.

Pacific Equities for January stated that TWA has started well for some time but has been hamstrung for at least three months by the strike. The carrier's January 1962 net profit of \$1.7 million shows an industry gain of 15% over the same month last year but less airline Eastern and British experienced a decline.

United registered a slight 0.9% in-

United Moves to Halt Representation Vote

Washington—United Air Lines has voted against the National Mediation Board's bid for a 30-day strike to block an NMB representation election that could lead to union representation of 12,700 United employees by the Brotherhood of United Clerks (AW Feb. 11, p. 41).

United attorneys requested a preliminary injunction from the U.S. District Court here to stop the pending election called by the United clerks. United is continuing NMB discussions on the issue.

United contends that the strike, if made, would affect the 32,700 employees, 2,000 of whom are members of the International Union of Machinists, while it is proposed to classify them under NMB rules in a single "class" or make them non-represented. In only one union, it has asked the court to prevent NMB from either holding the election or to name a union representative for the group, since the board has found that private United is preferable to a union on the class and craft representation issue.

NMB should also be ordered to change its present ballot form, because this fails to provide any means by which carriers can vote against union representation, the attorneys insist. In the present case, members of the 12,700 employees being solicited could conceivably vote in union representation since all ballots can be blank, or with the notation of "no union representation," which would be ruled invalid by the NMB.



Canadair Proposes V/STOL Transport

Montreal—A transonic Cessna V/STOL transport shown in artist's concept is designed for a variety of military roles (AW Jan. 25 p. 36) and possible commercial applications. Wing 140 through 190 deg for vertical flight with longitudinal control provided by roll of trim. The prototype will be built under a research and development program with Canadian investing \$2.5 million and the Canadian government \$7 million.

Eastern Air Lines, Northeast, Northwest and Southwest—Continental Delta, National and Northwest—which round violent objections to statements by American and Eastern that the industry is "weak" (AW Dec. 14, p. 40) equated a total net profit of \$4.7 million for 1962. This is half that amount, however, as represented by Delta's \$11.3 million profit.

United's battle during January continued as domestic load with all 11 trunk routes showing a decided dip with the exception. While United's domestic and transatlantic 49% and Continental's 49% and Northwest 49% and Southwest 49% and TWA 49% all declined 21% during January.

Its midwest coach revenue percentage showed mixed results: Northwest Coach rose for all 11 midwest routes 15% compared with no midwest air

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provement in traffic. Northeast, Northwest and Southwest 15% improvement. Southwest increases were reported by Continental Delta, National, Northwest and Western.

United's coach seat sales for the midwest rose 24.4% with Western and Delta having the biggest gain on the route. Northwest's midwest seat sales for the group dropped 4.1%.

The changes passed may be the low point in the industry's battle for the first-class load factor. In January, Northwest's load factor fell 15.2% from the 49% reached by January. Continental's load factor fell 19.7% compared with 47.5% the same period. While Northwest experienced a decline in 19.5% from 46.5% Delta was best in this category with 16.7% load factor.

Recent activity of the 31 trunklines is reflected in their common stock list, including the New York Stock Exchange, Bourse, Continental Delta, National Northwest and Western last week were selling near 1962-1963 highs.

Airlines Start Attack on New U.S. Policy

By L. L. Doty

Washington—U.S. international airlines last week took major steps toward the organization of a campaign designed to subvert the proposed White House policy on international air transportation (AW Feb. 11, p. 38).

As of late last week, the five carriers that had been invited by the Federal Aviation Agency and Civil Aeronautics Board to an initial meeting earlier this month, were in general agreement that the policy, as it now stands, can have damaging effects on the competitive position of U.S. airlines operating overseas. There was some disagreement among the carriers on minor points.

Top officials of Trans World Airlines and Pan American World Airways are taking the lead in attacking the policy on grounds that it is discriminatory and to the detriment of both of the two carriers.

Indications now are that top powers within officials—including several in cabinet levels—have committed themselves to supporting the proposed merger of Pan American and TWA.

Opposition is found in the second-tier group, including those who drafted the policy.

The campaign will be directed against this group in a first step toward bringing about revisions in the policy that will make it more acceptable to the airlines. The second phase will be to have the policy set back again under scrutiny when it has been a casualty of the policy makers that the airlines would consider it struck.

The airlines have been denied a right to participate fully in the development of the policy and any consultations held with the industry have been conducted on a highly restricted basis. It was only after a disclosure that representatives of the State Dept., the Civil Aeronautics Board and the Federal Aviation Agency were planning to discuss the policy with an foreign government before revealing its contents to U.S. carriers that the government bowed to industry demands that the airline be presented to review it.

After the hearing of the five carriers, held behind closed doors, the heads of the airlines present were obviously angry. Charles T. Tidwell, president of TWA, and James Trropic, president of Pan American, were particularly annoyed.

TWA and American, due to fight the policy and was targeted for removal into light aircraft work. At least one congressional and one senator, both Democrats, have expressed an intention to support the merger in re-

sponse to the two airlines' outcries. These are the chief parts the airlines are planning to use in their attack on the policy, although a formal proposal has not been fully prepared for all airline members.

• Policy puts the U.S. airlines at a disadvantage in comparison with the foreign carriers serving the U.S. The industry believes that to compete effectively, the U.S. cannot be hampered by a foreign relations policy that violates normal interests in a free competitive function.

• Standards established in the new policy are inferior to those set by the Congress in the passing of the Federal Aviation Act of 1958.

• Indifference by the policy makers toward the part played by the U.S. airline industry in helping to develop the policy—the flow of dollars from the U.S. to foreign countries—has raised strong objections from the carriers. This issue will undoubtedly win the main issue support of the airlines in the fight against the policy. Airlines will hold the line, nevertheless, of their competitive relationship with foreign carriers will only compound the current U.S. unfavorable balance of trade.

• Airlines will take strong issue with attempts to redefine such freedom policies. In addition, they will argue the necessity for some form of normal cost capacity and schedule frequency offered foreign carriers in their operations to and from the U.S. The policy proposes that foreign carriers be granted capacity to match usual traffic volume catches up with seat order offered.

• Caution should be exercised in the policy's position in support of lower fares, according to the airlines. The industry feels that U.S. airlines have been leaders in the promotion of lower fares, but that rate reductions cannot be brought about too rapidly until it is adequately determined what effect the reductions will have on revenues.

• Policy makes no provision for expanded cargo air mail operations but has the full support of Seaboard World Airlines, since this carrier has long advocated such a program. Other airlines, however, will argue that any expansion in cargo operations could become permanent fixtures. On this basis, they will argue, it would be a wise policy to make no binding commitments on cargo operations until the flow of traffic is more firmly established.

First-Class Revenue Drop Spurs Support for Single-Class Service

Washington—United Air Lines proposed one-class service in drawing increased support from carriers critical of the concept of coach and discount fares which have diluted the industry's first-class revenues.

Support of the idea came when United first will switch all its flights to one-class service. Other carriers also believe that one-class service is the only just way instead of increasing revenues during the present period of continued coach growth. Revenue spread between coach and first class now stands at 16-25%, and past industry attempts to reduce this gap to at least 5% have been consistently rejected by the Civil Aeronautics Board.

Basically, the United proposal is a 5% more costly coach service with better seating and service surroundings than Economy. At the same time, it will offer a 10% discount between Chicago and San Francisco. Ticket one, which will be \$111, is now \$101, with a one-class fare of \$119.

Supplemental United did not place the new service on the highly competitive Chicago-Los Angeles route where



Boeing 727 transport made its first flight on Feb. 9. Aircraft took off from Renton (Wash.) Municipal Airport and landed at Paine Field, Wash., 20 mi. north of Seattle. Planes was airborne 2 hr., 1 min. Aircraft's performance and handling characteristics were investigated.

Boeing 727 Transport Makes First Flight



Aircraft is powered by three Pratt & Whitney JT8D turbofan engines, each rated at 14,000 lb. takeoff thrust. Two are positioned on either side of the air fairing and the third is fitted into the tail cone. During test flight, 727 weighed 150,000 lb.





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3. Shorter length requirements of less than 1,200 meters. This is made possible through a high lifting capacity to weight ratio, greater power relative to weight, and propellers with 14° 6° dihedral.

4. Efficient operation at high ambient temperatures. The YS-11 is powered by specially designed Rolls-Royce Cobalt 100 turboprop engines which operate satisfactorily in high ambient temperatures and can maintain constant take-off power between ISA-35C and ISA-80C. These three advantages alone make the YS-11 worth consideration in areas where existing aircraft are considered to be transportation impractical. Write for complete information about the YS-11 to:

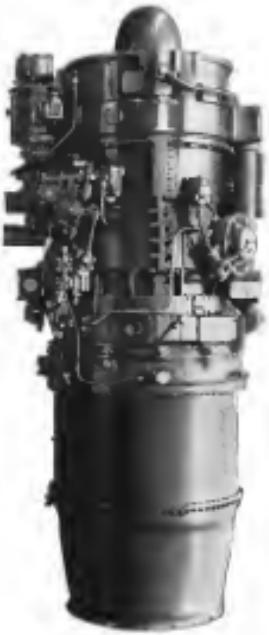
NIKON AIRPLANE MANUFACTURING CO., LTD.
1-10-10, Ochiai, Tama-ku, Kawasaki, Kanagawa 210, Japan
TELE: 046-521-1111



Airline Income and Expenses—November 1962

(IN THOUSANDS OF DOLLARS)

	GROSS AIR REVENUE						Total Operating Expense	Net Profit (Loss)
	Passenger	Cargo	Other Non-Mail	Mail Air	Aircraft Lease	Total		
DOMESTIC AIRLINES								
Aeromexico	21,144	3,483	523	590	33,819	56,009	(44,165)	
Alitalia	2,957	411	264	110	8,212	8,827	1,170	
Algerian	4,642	27	129	18	4,242	4,710	1,468	
Alitalia	14,721	2	216	216	11,412	15,720	2,608	
Alitalia	10,249	1,526	294	420	20,870	23,913	11,934	
Alitalia	8,456	547	164	150	7,340	7,504	147	
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Alitalia</td								



Tough guy

The toughest proving ground for any new engine is in transonic aircraft, where the Bristol Siddeley Viper gas turbine made its reputation. In seven years Viper-powered transports have entered service in six Air Forces of the world. Add this to the fact that Vipers have also featured in every other type of aircraft including executive, research aircraft and fighters and you have world-wide proof of ruggedness and reliability.

The sheer simplicity of the Bristol Siddeley Tropic is the basic reason for its reliability and ease of handling. It has also been a major factor in the rapid development of the engine from its original rating of 1,473 lb. The latest version, the Tropic 20, is rated at 3,000 lb. thrust and

powers the de Havilland 660 Liner and the Paggio/Douglas TD 300 executive jets. The engine is now under development to even higher thrusts.

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TWA Will Seek Hughes Default Order

By James R. Ashlock

New York—Detroit's proposal to force Trans World Airlines in its \$115-million suit against the Hughes Tool Co. will be rejected if the air line has this week as a result of Hewson R. Hughes' failure to appear last Monday for pre-trial examination (AW Feb. 11, p. 39).

Attorneys for the airline said they would also file a motion for judgment on Hughes' \$33-million counterclaim against TWA's manager, assistant attorney and the current financial director. It granted him, the court, a discharge with pretrial expenses having incurred.

Before asking for summary judgment, TWA's attorneys also seek default of Hughes' 75.2% of controlling stock in the airline. The carrier's last two court hearings last week that began Hughes had entered into a self-full default. TWA used to serve everything in writing.

However, Hughes' lawyer said that an adverse judgment will be carried over to the Civil Aeronautics Board and to the U.S. Supreme Court if necessary. Then, without ever having cause to trial, the case could still drag on for years more.

U.S. District Court for the Southern District of New York was notified on the Friday before Hughes' scheduled appearance that he would not appear in Los Angeles, in protest.

Charles C. Davis, Hughes' lawyer, told Judge John M. McNamee in New York that he was mapping his pretrial activities in the case, and that there was no need for Hughes to appear.

Flying Tiger Debt

New York—Contract agreement with Canadian, Ltd., which asserts further debt obligation until a major part of the loss on CL-44 aircraft has been paid, is driving Flying Tiger Ltd.'s move to dismiss two EC-135 freighter lawsuits. The court has already excluded

Flying Tiger from the suit against the tool company until the court can determine if the debt is still outstanding. The order is seeking some modification of the Canadian suit that would clear the way for the CL-44 debt.

Likelihood of freight freighters in question by its competitor, plus Almaty Air Transport holder's insistence that payment options will be used for military procurement, are factors that prompted Canadian to sue for the EC-135. Canadian can operate 10 CL-44s.

Only settlement discussions to arise came since TWA filed its suit. The two companies proposed an arrangement whereby TWA would take a contingent of Concorde 100, 837M and

990 aircraft that Hughes had contracted to buy. In exchange, Hughes would pay the airline with funds held in its \$100 million through a purchase of debentures.

But TWA's new management headed by Ernest R. Borek, claimed to press its claims in hopes of eventually securing an share of Hughes' ongoing interest in the airline.

Still pending a *Debt* application to the Civil Aeronautics Board asking for an injunction into the partnership between TWA and its co-owner on one hand and Pan American World Airways on the other.

Debt was to clear up the question of whether the TWA-Hughes dispute belongs before the court or the CAB. The other was to determine that the proposed TWA-Pan American merger might be a "rampantistic conspiracy" formed in the leading institution. TWA's management and Pan American without regard to Hughes' interest.

TWA and Pan American last week submitted to the CAB that debt should be held a stockholder's role on the merger within 60 days after finalization of the proposed CAB Board of Directors. Counsel for TWA received a copy of the order, noting it provides no CAB action primarily because of uncertainty over Hughes' position should TWA vote its stock.

TWA argued that there was no need for the CAB to decide this question. The airline and it last month gave up its right to vote the stock, and that the CAB should expedite its procedure to that public hearings can be held within a reasonable time.

MATS Requirement

Washington—Midwest Air Transport Service has been awarded that airline's all-future MATS sublet contracts will be awarded to private firms powered aircraft.

Out of 15 announced earlier this year, only one regional carrier was not awarded a five-year contract. MATS said that firm was not privately negotiated for this equipment.

No new routes will be selected for bidding MATS and Foothills 1664 contracts will be awarded through contract negotiations held by the airlines.

Military requirements alone should not be the basis for practice of new or additional turboshaft engine aircraft. MATS warned. Expansion of the airline's order book should be the first consideration, MATS said.

Now look what they're doing with the amazing F-104

They're hanging six air-to-ground missiles on it. Count them. Or seven 200-pound bombs. Or a mix of bombs, napalm, rocket pods, trap dispensers, whatever the mission calls for. Because now the

F-104 is something new indeed—a versatile and highly effective close-support weapon system.

This version of the F-104 Starfighter will come as no surprise to F-104 pilots the world over. They've

always known the F-104 was an extremely stable platform, able to handle a wide variety of missions. This same plane can be quickly turned around and sent up as a Mach-2 air superiority fighter.

The F-104 is unique in this age of specialization. It will tackle just about any job you hand it, and do it well. Best of all, it is a proven airplane that can be delivered quickly. **Lockheed F-104**

LOCKHEED-CALIFORNIA COMPANY, A Division of Lockheed Aircraft Corporation, Burbank, California



AIRLINE OBSERVER

SHORTLINES

MATCHED TO THE JOB!



Long-range Lockheed P-38 Orion...designed for anti-submarine patrol warfare with U. S. Navy.



GM's commitment and quality engineering will continue to reward GM's tradition of high standards of quality and reliability.

LONG-RANGING SUB-CHASER COOLED BY GM-HARRISON!

EXPERIENCE provides an invaluable source of knowledge for CM-HARRISON engineers. Aerospace, nuclear, medical, industrial, automotive. Every type of Harrison heat exchanger owes much to the familiarity of Harrison engineers with heat control problems in all these fields. This experience, and a complete line of basic designs to choose from, are the chief reasons why Harrison temperature control equipment is exactly **MATCHED** to **THE JOB**... to provide an ideal combination of performance, reliability and economy.

• **Aeroflot** is morphing the difficulties involved in maintaining its newly-minted scheduled widebody Tu-154 service between Moscow and Baku. On the first few of the "regular" flights to the 8,250-m. run, the large, double-deck Tupolev transport carried as few as 25 passengers eastbound. Apparently none of the flights is carrying a load close to the 70-passenger capacity of the aircraft.

► All expense revenues totaled \$58.4 million in 1982, a 82.6% increase over revenues earned in 1981.

► American Airlines has filed a suit with the Civil Aeronautics Board calling for a half-bird family plan on all intra-city flights every day except Sunday. Current family plan provides a one-third discount for all family members except the family head when traveling together, and is in effect only from Monday noon to Thursday noon.

► But officials now place a CAB decision in the Amerson-Eastern merger no earlier than June. One suggestion is the case start this week.

► British Overseas Airways Corp will resume twice weekly Boeing 707 service between Hong Kong and Sydney beginning in April. Service on the route was suspended last summer.

► Eastern Air Lines has contracted for Southern Airways to handle all Eastern ground operations at Dallas and Muscle Shoals. Also, under the plan, Southern will perform all ticket taking, passenger service and cargo handling for Eastern's two daily flights through these stations.

► Friction Aviation Agency is conducting tests to measure the range of communication between ground stations and airborne aircraft. Test facility has been installed at Wrentham, Mass., and includes a large, high-gain antenna 138 ft high and 100 ft wide, and a 4-kw. transceiver.

• Kuwait Airways has joined the International Air Transport Assn., bringing total IATA membership to 93 airlines.

• National Airlines flew 3346 million revenue passenger miles in January, an increase of 17.8 million—or 10.5%—over the same month of 1952.

Pan American World Airways will schedule 204 roundtrips flights each week during the 1963 summer season. Total of 413,000 seats will be provided each week during the peak season.

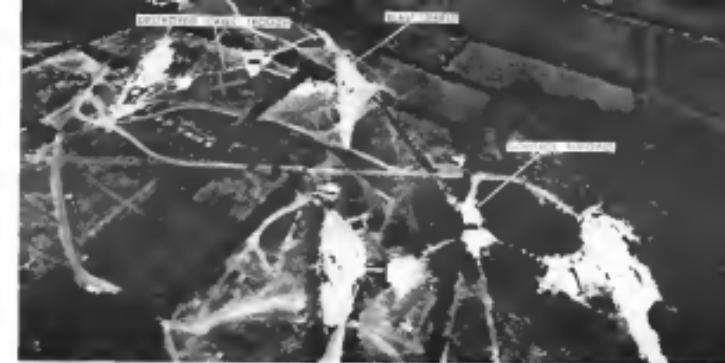
The logo for HARRISON is displayed. It features a large, stylized letter 'H' composed of two intersecting diagonal lines. To the left of the 'H' is the word 'HARRISON' in a bold, sans-serif font. Below the 'H' and the company name, the text 'INDUSTRIAL, MARINE AND AIRCRAFT HEAT EXCHANGERS' is written in a smaller, all-caps font.



High-altitude photo (aerial) of Biscanabo IRBM site on Jan. 26, 1963, shows it depicted with concrete launch pads broken up, control and power status cable trenches filled in and no sign of any activity at the site. U.S. astronauts regular high altitude photo-reconnaissance or radio. Island of Cuba as a substitute for entire inspection mission originally demanded for the Soviet missile complex.

New Defense Department Photos Show Rapid

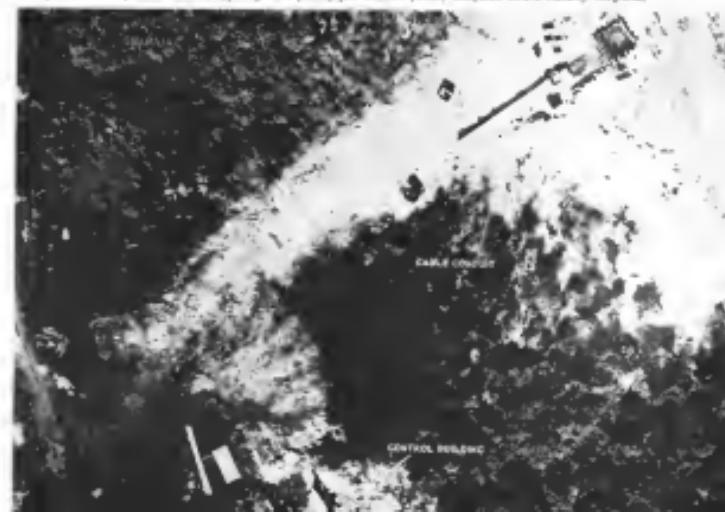
Low levelelligence photo (below) of Kremesov IRBM base taken Nov. 9, 1962, shows a broken out battlefield concrete launch pad with power cable trenches filled in. Note the prefabricated concrete hollow blocks used as bases for the utility trenches.



Low level photo (aerial) of Lantana IRBM site (SRI) Nov. 1, 1962, shows beginning of dismantling of site complex which had been serving completion. Work has been started on all construction. Concrete launch pads are being broken up by high explosives shells and utility trenches are being filled in. Cable cables have been removed. Note blast shield for fueling vehicles over each IRBM launch pad and incomplete launch control building designed to handle launching on two pads.

Disassembly of Soviet Missile Sites in Cuba

Medium level photo on one of the two Gromov IRBM sites taken Nov. 1, 1962, shows construction still proceeding on launch pad complex. Note deep concrete base, upper right, for posing part here not partially completed control building, foreground.

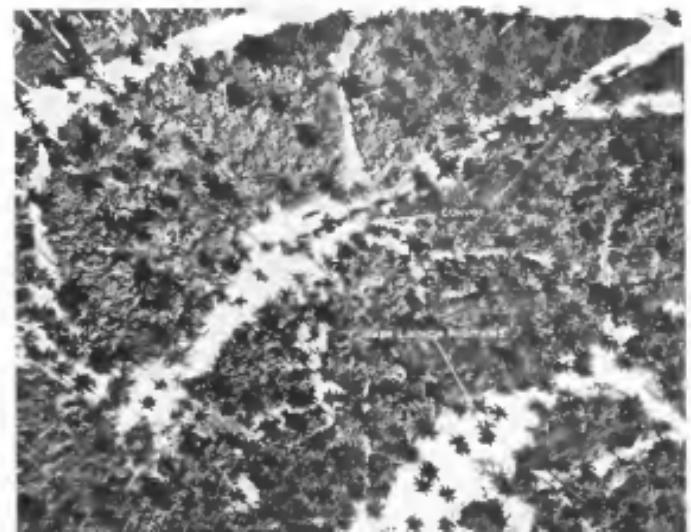




High altitude photo (above) taken Jan 27, 1963 shows detailed the No. 4 in the Sun Cratered complex of Sandia NMHM aquifer. All wells and support equipment has been removed with destruction of backfilling material and no signs of any recent activity in the area. Low level photo (below) of Site No. 4 in Sun Cratered complex taken on Oct 29 shows Sandia NMHM aquifer in state of full operational readjustment at a well prepared backfilling site. Four backfilling pit headstocks are equipped with nozzle erosion and flow control. Trucks loaded with construction equipment and debris are still continuing to improve the site.



Low level plant (third) of the San Cipriano MBRN is No. 1, was taken Oct. 25, 1962 and shows that the Sander population displayed her best observed oviposition methods with an eggplant and bunching potato surrounded under dense tropical forest. Larvae, pupa and diagnostic gills good detail on how Sander male-male combat equipment is deployed around the female bunch. U.S. photo-macromacule No. 1, 1962, also shows the described male combat with the full array of weapons deployed around the female bunch. The Sander male combat with the female bunch is clearly displayed in U.S. photo No. 1, 1962, and when related characters were shown departing on forest slopes from Caliban posts.





**EXIT
HEAT**

Hamilton Standard's heat transfer experience is being focused increasingly on space life-support systems. Present work includes development of the first integrated space-seat assembly for NASA's Project Apollo and practical application of such techniques as evaporative cooling, space radiators, advanced design heat exchangers, and heat sinks for varying crew sizes and evaporant loads.

Hamilton Standard's life-support program applies diversified experience in hydraulics, pressurization, mechanics, electronics, and packaging. Hamilton Standard blends and develops these basic technologies to achieve an integrated systems approach to life-support equipment.

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SPACE TECHNOLOGY

Manual X-20A Boost Control Simulated

By Erwin J. Bellino

SAN ANTONIO. Simulated flight control operations in a centrifuge have shown that pilot training for the USAF's Boeing X-20A space glider can easily control the Dyna-Soar's boost stage and orient the vehicle into its proper orbital injection window.

Centrifuge operations were conducted at the Naval Air Development Station at Johnsville, Pa. A report on the results was submitted recently by Le C. Bellino, who is a research engineer assigned to the Dyna-Soar program director during the USAF School of Aerospace Medicine's annual Institute series of biannual AFRL tests.

Tests, carried out as part of the standard pilot training, included use of the X-20A seat, pressurized (15 psi) and unpressurized.

Testing the seat in either condition did not discuss the occupant's off course. Results said:

There were additional proof of the effectiveness of the Dyna-Soar's seat, but the seat is not a big part of the X-20A program. The Clark gas assist is one piece and uses upper and lower, with separate glider demand at about 1000 psi.

Separate gliders were chosen to obtain the necessary of dissolving the equipment should damage to the glider be discussed while raising up. Gliders also use using pressurized. Astronaut normally would not cause the glider portion down. Right. Conventional flight boots also are used.

Helmet Design

Helmet design has not yet been finalized. Dyna-Soar program personnel are working for a configuration that will be fixed to the seat to provide maximum torque on the pilot's head when he makes head movements. The design would also incorporate a fixed fairing which on the current model would provide 110 deg lateral range, 45 deg forward and 70 deg downward.

Design calls for a large fairing which the pilot controls through over-ruled. Helmet has demonstrated approximately 20-40 deg better lateral range than the helmet used on the A/P125 seat.

X-20A will incorporate flotation capability not provided in the A/P125 program.

Dyna-Soar environmental control system (ECS) will provide a 45.5% oxygen and 53.5% nitrogen atmosphere for seat

ventilation, pressurization and temperature control. The same gas will also be provided by oxygen pressure and ventilation. The normal ECS will be selected as preference to a 100% oxygen system because it supports combustion less readily and is considered safer. Relative humidity will be controlled by a condenser which absorbs in the cockpit, which will not be connected to the pilot's seat. Seat ventilation will be at the rate of 13 on off.

Cockpit Pressure

ECS is designed that an automatic seat valve in the electrical system will not release until heating or pressurization gas supply. Design seat lock rate is 165 deg/sec. With a 250 lb/sec pressurization supply, there is a constant lock rate allowing CO₂ to be dumped overboard.

Structural and cockpit cooling during steady will be provided by a circulating glycol/water mixture and the design calls for cockpit temperature throughout the system to stay from +150 to -160° circa through parts of the spectrum with cooling to 40000 ft.

Extravehicular gear will be designed to absorb during reentry flight. Since the X-20A structure is designed for +3-g to -1-g stress and there is more susceptible to impact damage than a

conventional jet fighter, the pilot will wear advanced landing as a prepared seat step.

Seat will be available from one degree forward of vertical, which the pilot will use while the X-20A rotates in the control position prior to launch to 15 deg off of vertical for horizontal flight. It is positioned throughout the 15 deg adjustment and can be set by the pilot at an angle in that range. Seat is designed and built by Weber Aircraft Co. and will undergo vibration testing on the high speed track at Holloman AFB in April 1964.

Part of the parasite system, including the seat, will be built and receive final assembly and validation for this April at AFRC Center, Calif.

Seat will have a small supply which will dump at option to provide a seat lock. A seat lock will also be fitted to dump at a predetermined depth after a water landing.

New RCA noise barrier radio will have five watt output, providing a sig over a 100 ft range, at range of 20,000 ft.

In addition, the X-20A will generate a special signal as multistage boosters of the pilot's seat are ejected.

Hammer schedules an air-supplied velcro. Transistor will include body pressure, respiratory rate and call time, electroencephalogram, pilot skin tem-

NASA Begins Biochemical Fuel Cell Program

Los Angeles—Exploratory research programs in biochemical fuel cells aimed at determining whether such electrical power can be derived from human waste during long-term space missions will be initiated within the next two years by National Aeronautics and Space Administration.

Contract totaling about \$250,000 was being negotiated with three lead research organizations:

- Armstrong Dev. of Ford Motor Co. will conduct a basic study of the electrochemistry of the synthesis of human waste, urine and feces.
- Major Products, a subsidiary of Thompson Ramo Wooldridge, will empirically prepare a fuel cell using organic materials, such as urine and feces, to see if it is feasible to convert human waste to electrical energy. Major has been conducting research in biochemical fuel cells under Navy sponsorship.
- Marquette Corp. will try to design an entirely new approach to the biochemical fuel cell and construct the necessary hardware for the experiment.

The three companies will exchange information on the progress of their efforts under NASA direction to merge initial cross-technology of ideas. A fourth lead, NASA's Ames Research Center, will be closely associated with the three new biochemical fuel cell activities. General Electric's contract deals with waste management.

NASA feels that the need for the application of energy conversion from human waste should become more practical for space, would not materialize before the long-duration space missions of the post 1970s, according to Walter G. Scott, head of NASA's power technology program. Scott reported on the progress of the agency's National Water Conservation in Military Electronics held here.



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The problem centers around a thin boundary layer of air that flows next to the surface of an airplane in flight. This air becomes "turbulent" as it passes over the wings, causing a sharp increase in friction drag — drag that robs the plane of speed, range, and engine power. This turbulence has nothing

to do with bumpy air; it occurs even when the plane ride is as smooth as silk.

To overcome this problem, Northrop has conducted a 14-year research program, and has developed a system called Laminar Flow Control. Row after row of paper-thin slots are put in the wings of an airplane. At the base of these slots are pressure holes. A pumping system inhales the boundary

layer air through the slots and holes and expels it to the rear. *Voilà!* Eighty percent of the friction drag from boundary turbulence is gone.

Laminar Flow Control will make it possible to exceed the range, endurance, or payload of large aircraft by 50% or more — with no increase in fuel consumption. Best of all, perhaps, is that it can be added at very minimal cost. And that

initial cost is quickly recovered by economics of operation.

Laminar Flow Control is being applied by Northrop to two U.S. Air Force jet aircraft, which will be designated X-21's. These will be flown in 1963 to demonstrate the new technology. Results of these tests should radically alter the fundamental concepts of large plane design, economics, and missiles.

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portant and pressure are maintained low with 1 cu ft min oxygen gas pressure, nitrogen pressure, complete pressure, 7 psi oxidant temperature and oxidant rotation.

Instrumentation support responsibilities has been delegated to USAF Flight Test Center at Edwards AFB under Dual-Site System Project Office supervision. General technical support will be provided by Capt. Raymond Vogt.

Dawn Star program probably will require some major modification in the present ground tracking system, partly due to the fact that since it is an intermediate system, it will have to be modified to interface with NASA stations which have limited data exchange. The form of this agency's contract and exact data sharing.

So far, close to the project is that DawnStar will utilize super high-frequency communications to overcome the blackout caused by formation of a plasma shield around space vehicles during re-entry. Reason for attacking the communications blackout is that DawnStar's remote probe would travel in or out of communications using conventional systems for about 25 min. That is four times as long as the current system. Many options are being considered, including use of USAF. These super high frequencies will be used in addition to existing tracking stations. Cost estimates are expected to be provided by Perdue-McIntire Range Lab 21.

Structural drawings for the X-20A have been released to the design firm. First airframe is scheduled to go to Wright-Patterson AFB. No final plans for configuration have planned flight of even

structural sections will be as close to predicted flight performance as possible.

Orbital unassisted orbital flight is scheduled. This will either take the form of Minneapolis-Hennepin metal guidance system. After assembly, a special digital control system adopted from the USAF's D-104 target drone program will explore the Dawn Star for landing at Edwards AFB.

Components and systems testing at rents is under way. Minneapolis-Hennepin will conduct captive flight tests of the X-20A metal guidance system in a McDonnell D-104 over the Eglin AFB Test Range. Most of the work of the project will be done at Edwards AFB. Guidance system has been improved in increasing the capacity of its memory storage.

Another F-104 is being the sole test aircraft at Edwards AFB and RCA electronics group also will undergo flight trials at Edwards AFB.

Now, cap accomplished several full scale tests in December by Charles Young. Status-of-development backlog has been broken through. Design, cockpit geometry and equipment layout has been determined for single-seat version. Although a weight constraint which would affect weight capability of the liquid-fueled two-stage rocket to calculate orbit would require additional component.

X-20A has considerable weight for storage of additional expendables needed for multi-orbit mission. These would be placed in the booster stage—located between airframe and transstage.

Orbits would be located in the 75 to 80 km apogee/payload compartment

Soviet Optical Observation Program

Moscow—Program of optical observation of Soviet and American satellites has been defined and is being carried out by the institutes of sciences of seven Soviet

and non-Soviet countries, according to Tass.

In All-Moscow observatory of the Soviet Astronomical Council and that of present there are 90 optical tracking stations functioning in 10 districts of the USSR. In 18 months of 1962, they carried out 47,600 observations of 12 Soviet and 15 American satellites. About 14,000 observations concerned Komsat 1, according to the Soviet tourist.

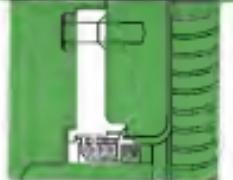
Soviet Moon observation program includes USSR, Czechoslovakia, Poland, Bulgaria, Hungary, East Germany, and Mongolia. Czechoslovak's first center will set at the single time service for all stations of the European Committee of the Ministers and. New stations for photographic observation of satellites will be established in Hungary, Mongolia, and the Far Eastern regions of the Soviet Union. This was stated at Hungay, East Germany, USSR and Czechoslovakia will carry out joint visual observations of Soviet satellites in the German sector.

New stations are to determine changes in orbital height within short time periods. This was described as "sight intercepting" for the study of brief variations of atmospheric density at altitudes of 200,000-250,000 km.

Also, the program of continuous photographic observations of the American satellite Komsat 1 had been worked out and would be supplemented by a group of stations in the USSR, Czechoslovakia and Poland. Dr. Mavroff's stressed that purpose of this program was to determine occultations of both the satellite and of tracking stations. (See ref.)



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\$30-Million Space Test Facility To Allow Apollo Mission Simulation

Los Angeles—Crews of Apollo and large space vehicles will simulate operations of those vehicles and their payload equipment in a lunar mission environment in a \$30-million test facility (AW Feb. 4, p. 510) to be built at National Aeronautics and Space Administration's Manned Spacecraft Center here.

Test facility will be located in a complex adjacent to a building competition expected to begin late this month or in early March. Award will amount to about \$4 million.

Facility will permit rotation of the space vehicle during mission simulations in a chamber to duplicate effects of solar radiation on the surface of the spacecraft. It also will enable crews in space suits to exit from the space craft and simulate lunar surface operations. The test facility will also simulate an actual mission to evaluate procedures and equipment.

Since the facility will expense leases to this largely nonresidential, it must be maintained with central systems of extreme reliability to insure their safety. An emergency power provision will include changing chamber atmosphere from a test environment approaching 10³ mbar to 10 mbars, altitude in about 30 sec., with provision for an lock so that space personnel can enter the chamber to assist test operations.

The \$30-million facility will consist of a chamber building, administration structure, and pumping building.

Chamber building is a two-level, reinforced concrete construction structure with four two-concentric-chamber bays. In the main vessel 65 ft is the diameter and 120 ft tall, dashed top and bottom, with an opening in the side approximately 40 ft in diameter for insuring or removing large test specimens and equipment. The two outer bays will be 31 ft in diameter and 45 ft tall with a radius of 31 ft for holding Apollo command modules or other elements of the spaceflight system.

Testing will be accomplished by pumping liquid nitrogen into cryogenic panels surrounding the chamber walls. Solar radiation will be handled by a system of Boeing Corp. of America's standard housing their light into the chamber to reduce about 10% warming. In the sun vehicle's side. Approximately 24 to 10 ft will be required to develop the lunar surface atmosphere in the large chamber. Design criteria for simulating these environments are for mission lengths of 14 to 30 days.

Other specifications include a demand of 2 ft of average per year pressure, pressure at a pressure between 10 and 14.7 lb/in² (gauge) on earth at sea level, strings of 10-mm width, a standard of carbon dioxide and humidity from a 2,600-cubic-foot cabin, and relocations of oxygen and water.

AVIATION WEEK & SPACE TECHNOLOGY, February 14, 1963



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In order to qualify for these and other opportunities, you must have at least five years' experience and, preferably, an advanced degree. Applications are invited to: Aerospace Corporation, 1423 South Harrison Street, San Bernardino, Calif. 92314. Please send resume with to: Mr. Robert Duran, Room 101, P.O. Box 348, San Bernardino, California.



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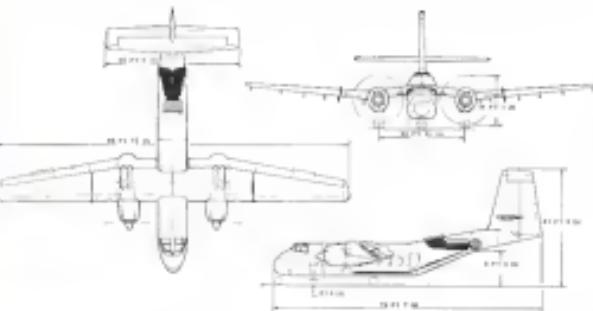


Flight & Space Division



XLO

AERONAUTICAL ENGINEERING



TWIN-JET REVERSIBLE THRUST program under development by de Havilland Aircraft of Canada is expected to give the Canadair utility transport a STOL capability of 800 ft over a 50 ft obstacle. Placement of the two jets and front wings in a sprague portion of reverse stage is shown. Reversible thrust concept is a marriage of de Havilland and Canadian Defense Research Board programs.

Caribou Reverse Thrust for STOL Studied

By Donald F. Frink



TWIN-ENGINE OTTER CONFIGURATION a stage three of a STOL study using a single jet reverse thrust engine. Two P6100 turboprops will give the Otter STOL capabilities of 800 ft with 40 mph approach speeds.



STAGE TWO OF STOL OTTER program model features the mount front package, left with standard main engine. P6100 sits on top of fuselage at wing root.

Toronto—Test jet convertible aircraft package, designed to improve the STOL capability of the DHC-4 Caribou will be developed by de Havilland Canada for STOL and reverse thrust to steep approach and short landing paths in under development by de Havilland Aircraft of Canada.

Reversible-thrust concept is the outgrowth of a DDCI research program which has been partly funded by de Havilland and the Canadian Defense Research Board since 1956. Consideration of using a jet engine for in-flight reverse thrust has been made with a single General Electric T53 2,000 lb thrust engine mounted in the cargo compartment of a DHC-1 Chipmunk.

Caribou package will be mounted in the sprague portion of the propengines, which will allow overhead clearance for the upward-swinging rear cargo door. Package will consist of:

- Two P6100 engines, which will be mounted out toward tailfin main ports in each side of the fuselage.
- Ducts to intake air from the forward sprague portion of the engine and feeding air to engine intake ports.
- Standard P6100 thrust diverter to divert the thrust from either engine to approach exhaust port if one engine fails.
- Vertical exhaust nozzles which will



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permit normal deflection of thrust lever takeoff and forward deflection to control the rate of descent on steep approaches and for added braking power at touchdown.

Tolcroft will be using capabilities of 50 ft over 50 ft elevations are assumed in zero wind conditions and at full gross weight of 25,500 lb. Steep approaches and short landing rolls will be made by using constant power set backs on the main engines and varying the reverse thrust to regulate the rate and angle of descent. Full reverse thrust plus reverse propeller thrust will be used to shorten the landing roll.

Striated Garber fall-offs, double slotted flaps and large tail surface area are especially expected to provide sufficient air asymmetry and control during the slow, steep landing approach. Aeroflo, over the control surfaces also can be improved during approach by increasing the main control power settings and balancing the uncentered pilot weight source. Aiming to focus the approach

Boundary layer control studies also are being conducted, but BLC will not be used until control surface performance in the standard configuration has been fully explored.

No major airframe modifications will be required to install the reversible thrust package, but extra JP 4 jet fuel tanks will be required on the Cessna 1, which is powered by two Pratt & Whitney R-2008-7M2 piston engines. An integrated fuel system will be possible on the larger Cessna 2, now under development (AW July 23, 1988), once it will be powered by two T-64-GE-1 2,850-hp turboshaft engines.

Funding for the Centoxin program will be split between the Cleveland and the Defense Research Board. Dr. Hartland's proposals currently are under study by

permit normal deflection of thrust lever takeoff and forward deflection to control the rate of descent on steep approaches and for added braking power at touchdown.

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type will serve as the first test-

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TYPICAL STOL PERFORMANCE of single-engine Otter with avionic thrust β_{IS} shown in the split-frame photo sequence. Light at wing root fades at touchdown. Steep approach and short landing roll are made possible with the reserve thrust.



J-85 Engine Oil Tank



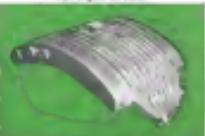
GE-400 GEM Oil Tank and Caster



J-20-11 Engine Oil Tank



J-45 Engine Oil Tank



J-75 Engine Oil Tank



J-85 Engine Oil Tank



J-100 Engine Oil Tank and Caster



J-105 Engine Oil Tank

cause is the fluid emulsification using the same Otto engine.

Bullet and caused on the first revision in the large Otto necessitated redesigning the horizontal stabilizer to give it a positive dihedral and move it above the domed nacelle (see photo below). The vertical stabilizer was then lengthened to reduce the tailplane and engine's effectiveness at low speeds. The horizontal stabilizer was also modified by shortening the tail surface to obtain a flat surface on the bottom.

Stall flight performance of the revised aircrafts. Otto was repositioned with the new flap configuration and stable flight was maintained at speeds approaching 50 mph.

Normal Otto stall flight speed at maximum gross weight is in the 60 to 65 mph range.

The revised-airplane studies completed this one of a three-stage program. When all Harbin engines had their low-gearbox sufficient data on the balance of control surfaces, Otto then decided to try. The new aircraft is a Harbin-Douglas design which will give the pilot positive control of the rate and angle of descent and power assistance at low speeds.

One refined airframe concept has been continued, however, now design the low approach speeds with the JES version is maintained by generating sufficient airflow over the Otto's standard control surfaces with the propeller slipstream.

The nose-high configuration was kept for the Otto when the JES was selected but the nose-low configuration was abandoned. The revised Harbin component provided higher nose configuration settings to improve slow

stall airflow over the control surfaces.

Leading gear on the STOL Otto is an adaptation of a standard fixed tricycle, which was chosen for the first revision as the easiest means of building a tricycle gear. This was done to shift the aircraft to a flying position on the runway and take full advantage of the aircraft's aerodynamics and ground effect. The configuration was kept on the second and third version because it proved to be a good configuration.

The JES version is the second version of the Otto to act on the cargo compartment floor. The rear article is fixed to the front of the landing gear to load the wing load. The front deflection post protrudes from each side of the fuselage at nose level.

Thrust from the JES is deflected equally to the two gears which channel it into exhaust baffles parallel to the fuselage. An outer counterbalance shield, mounting a sliding bearing, is used to regulate the direction of exhaust flow from each post. Two additional posts are angled forward to cover the front exhaust piping and the thrust is deflected forward.

An approach for leading the main power setting is established and the exhaust post shafts are rotated backward to deflect the thrust forward and create drag. The thrust is then regulated to prevent excessive heating of speed during steep approaches. If added power is needed quickly, the shells can be rotated forward to give an immediate forward thrust component. At touchdown full reverse thrust is used to shorten the landing roll.

Control surface design has not been fully developed but if available will unique collective rates similar to those



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Titanium Welding Performed Under Plastic

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SC real-time Coordinate Conversion Computer at Goldstone positions antennas tracking Mariner II and other space vehicles

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A Major Digital Systems brochure available from SC details ten years of experience with a broad range of space vehicle checkout and control systems. It also describes the SC space accomplishments, also with the comprehensive listing of SC's space products. An 80-page digestively organized 16-page brochure is available. Dept. 200, Computer Control Company, 10000 S. Cicero, Chicago, IL 60649.



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used on the British Mariner 10127 VTOF probe flights.

Two engine OTR have even less re-inertia in the standard aircraft than the earlier configurations. The engine is enclosed in streamlined cowling with the standard PT6 power intake on the bottom. The two thin-bladed Herstal propeller with 91 in. f. blades. The propeller, which can be feathered but have no reverse pitch capability, are the largest ever used on a PT6 engine.

New engine equipment has been installed in a shortened nose cowling which houses instruments for reading flight data and helps balance the aircraft. The wing is standard and was strengthened out at the root section to allow for the added weight of the engine.

Two engine version of the OTR which will be the same 35% more street weight, was completed in about three months. Flight tests are scheduled to begin that month.

Provision was made to go to a 1600 configuration in the future. To make further use of an engine, provision was made for the original auxiliary. The 35% re-inertia at the standard engine configuration proved the feasibility of the intense thrust control, but with limited forward power and departure generation capability, full potential of the 35% could not be realized.

Two-engine OTR is expected to reduce the landing distance to an average of about 450 ft. with an increased maximum gross weight. Boundary layer will be explored again, later in the program, using bleed air from the jet engine to increase aircraft surface efficiency for flight.

De Havilland engineers state that the OTR environment are strictly research and development projects and are not intended to produce an OTR STOL conversion package for widespread use.

Publication Planned For Scientific Reports

Washington—Institute of the Aerospace Sciences and Documentation Inc. will submit and index 40,000 scientific articles during 1965 as a gross figure calling for publication of abstracts each week.

IAS will abstract 20,000 reports and publish them in an International Aerospace Abstracts to be used on aerospace works. Documentation Inc. in fact, under a National Aeronautics and Space Administration contract, has already abstracted 20,000 articles and abstracts will be included in Scientific and Technical Aerospace Reports, which will be edited. ■

Canadian aviators will be noted quarterly by both publications.



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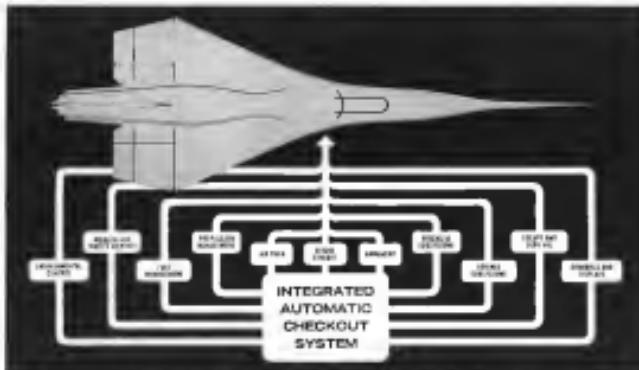
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Will future Avionic Systems



All basic integrated avionic subsystems could logically be maintained with integrated maintenance equipment.

This maintenance method would result in considerably more military operational capability per defense dollar.

Radio frequency fault detection at Honeywell

A Honeywell-discovered method of detecting potential circuit failures will provide higher reliability for Honeywell-supplied systems for the Comsat and Apollo Spacecraft. The method has already been proven on the assembly line of Honeywell's F-104 Flight Control System.

Termed "Radio Frequency Fault Detection," the method provides a significant improvement in product reliability by locating potential failures that even X-ray tests would pass as perfect. The slight imperfections of the electrical circuitry generate an RF noise easily detected at less than 25 MHz on an RF receiver. The test may be applied to entire systems as well as subsystems and components.



A Honeywell F-104 Flight Control System subassembly card is shown being tested by the RF Fault Detection method. The oscilloscope shows an intermittent RF noise produced by a faulty diode in the card.

Airborne computer monitors spacecraft systems in flight

Present day checkout and maintenance equipment will not be practical for the spacecraft electronic systems of the future. A small, simplified unit can be carried aboard the craft to do the needed.

Such a computer, called Micro Ace (Microminiature Automatic Checkout Equipment), is being developed under a Honeywell-sponsored program which already has resulted in circuit designs capable of monitoring and isolating faulty components in a spacecraft's electronic system. The computer will permit astronauts to monitor systems and predict an impending failure far enough in advance so that faulty components can be replaced before the mission is affected.

be maintenance liabilities?

Is industry meeting its responsibility to simplify avionic maintenance?

Industry's present method of designing existing avionic systems has resulted in high-performance weapon systems with excessive maintenance requirements—from 60 to 150 maintenance man-hours for every flying hour. Since only a fully operationally ready weapon system is an effective one, this extensive down time is a liability. It must be corrected before the weapon systems of the future are designed.

It is an industry responsibility to design weapon systems that provide a maximum state of readiness with a minimum of maintenance cost. To accomplish this, environmental orientation must be installed into R&D management. These key steps should be followed:

(1) Establish avionics system

management to provide unified technical direction and control. Integration and packaging of avionic subsystems so that they will function efficiently in concert with one another.

(2) Design avionics systems for maintainability. During the initial design phase, maintainability of the system should be given equal consideration with mission performance and operational environment. Maintainability should also work with reliability as a factor in equipment design. Avionics system management would ensure this:

- simple designs are used to reduce maintenance complexity
- built-in maintainability augments reliability
- concurrent design of the support

equipment is compatible with the basic concepts of maintainability and operability.

(3) Take advantage of technological advances to reduce the need for extensive electronic maintenance. By providing high performance avionics systems with greater reliability and maintainability (See examples below on RF Fault Detection, Self-Repairing Circuitry and Micro Ace.)

We believe these concepts will prevent the complex electronic weapon systems of the future from becoming maintenance liabilities. Our expertise in understanding both initial and subsystem maintainability equipment for different types of supersonic fighters—in addition to allied aerospace advances and management of military systems—fully supports this conviction.

For more information on avionic systems maintainability, write Honeywell Department 671-3, Minneapolis 20, Minnesota.

Self-repairing circuitry may provide automatic repair of space systems



Honeywell is researching two ways of inducing circuitry to repair itself.

The first involves coating a circuit with a special alloy. A small temperature rise at any break would cause the alloy to melt and flow into the break.

The second method (shown above) seeks to control the direction and growth of metallic whiskers (of the type that readily form on capacitor plates and produce short circuits) to effect a repair.



Honeywell's Automatic Analyzers provide standardization in performing aircraft systems analysis and fault isolation on the Canadian CF-104 (above), U.S. Air Force F-101B, Royal Air Force Lightning, Canadian CF-101, German F-104G, Japanese F-104J, and NASA's X-15.

This advertisement is paid for by Honeywell, not from government funds. It is particularly addressed to companies having help in areas where Honeywell experience can be most useful.

Honeywell

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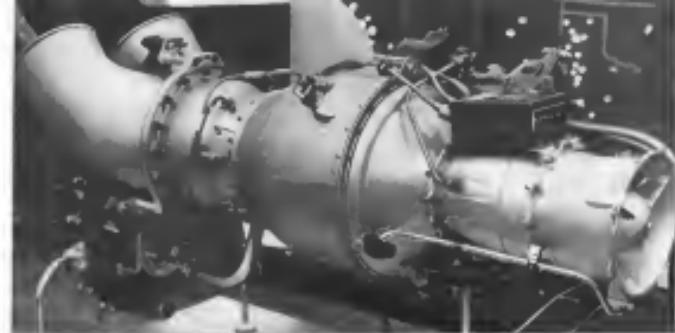
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MARTIN Systems Management



CONTINENTAL T65-T-1 turboshaft engine, due for its 100 hr. PFRT in October, has a flat 2100hp military rating to 13,000 ft.

Continental T65 Passes 50-hr. PFRT

By David A. Anderson

DETROIT—Continental Aviation and Engineering Corp.'s T65-T-1 turboshaft engine has passed an 80 hr. Preliminary Flight Rating Test (PFRT) and is scheduled to complete the 176-hr. PFRT this October.

The T65 has a military, at 30,000 ft, rating of 230 shp and is being developed as the alternate engine to Allison's T61 for the Army's light observation helicopter (LOH) program. Company says evolution of both engines is a short four-year span.

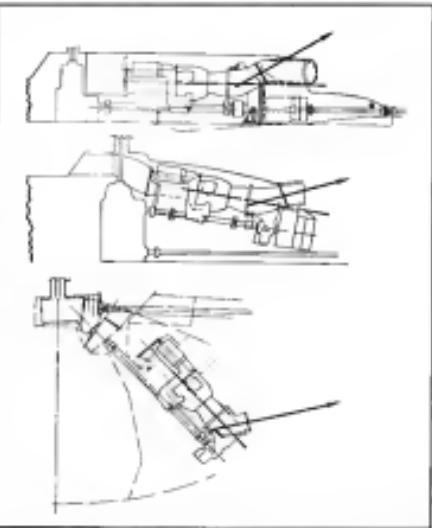
Development of the T65 is being financed by U.S. Army under a contract between Continental and the U.S. Air Force which is responsible for managing the project.

The engine was designed to meet specifications of both the military and the Federal Aviation Agency, and the company has applied for a type certificate for the engine.

Time schedule for the T65 development was so short that no new aerodynamic development work could be planned. Instead, the Continental design team drew on its background and that of Societe Turbomeca France and engine firm to work with CACI has licensing agreement.

Geometric scaling of many of the major engine components has been credited by Continental as the feature that helped them meet the time schedule.

Layout of the T65 follows the familiar air pattern developed by Turbomeca and Continental. Design point was chosen at 105 shp at sea level so that the engine could be started at a rate



T65 INSTALLATION position and exhaust angles are shown for the three LOH configurations: Bell OH-58 configuration, top; Sikorsky OH-58, center; and Hughes OH-6A at bottom.

no problem

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strength steel plate with 2" thick hemispherical ends. All welds are X rayed and tensile stress relieved and factory tested at 80% above rated pressure of 400 pounds per square inch. Finally it is cleaned for oxygen service, sealed and shipped ready for installation.

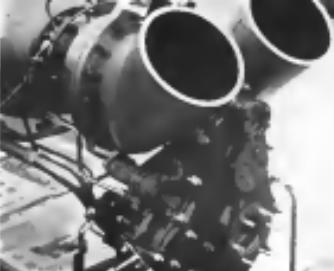
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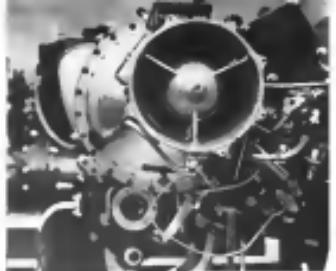
Plant and Office: 220-0100. Or write:



PITTSBURGH-DES MOINES STEEL COMPANY



EXHAUST OUTLETS OF THE T48, left, are circular in section and angled at 45 deg. instead of the engine's rectangular. Inside, right, is a single-stage modified bellmouth-type engine. It has five power takeoff points for accurate data, including one spin shaft.



start 250 hp, rise to 11,000 ft. The flat rating of the engine also means that it could deliver the full 250 hp at sea level on hot days.

The intake is a single-stage, modified bellmouth type. The engine air passes first through a single-stage, ram-air compressor and then through a single-stage, centrifugal compressor. In accelerating the intake air, the compressor blade is rotated by a rotating fuel vane.

The gas then mixes with

charcoal and expands through a two-stage, centrifugal turbine which drives the compressor by direct coupling. The exhaust then passes through a single-stage, axial-flow, free-power turbine which drives the output shaft through reduction gears.

Final discharge of the exhaust is through a flat outlet angled 45 deg. upward from the engine's centerline. Oval nozzles are circular in section.

Power takeoff is at the rear of the engine, just in front of the intake. A 7.57

in. below the nosecone of the engine is the location of the engine's installing parts. Maximum engine length of the T48 is 18.69 in. and the maximum width of the engine is 15.25 in. Overall height is 9.96 in.

Weight of the powerplant is 180 lb. This figure includes the fuel pump and restrictor, the lubricating pump and filter, the ignition rod, leads and plug, the propeller, the gear box, the housing, and the small engine lines and fittings.

Standard maximum thrust available for power takeoff and gas genera-

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MANAGEMENT

Textron Forecasts Rise in Defense Sales

New York—Defense segment of Textron Inc.'s air base manufacturing area is forecast to rise to 14% of total company sales in 1983, though due to increased helicopter business of Bell Helicopter Corp.

This forecast is based partly on a 30% increase in Bell Helicopter sales over 1982, resulting in Army UH-1H and UH-1H Iroquois deliveries, and orders for the Marine CH-46 transport.

Commercial helicopter business is growing slowly, Textron executives Vice President Harry Garfield told the New York Society of Security Analysts. Charter operations, a segment with just 10 years ago, has developed into a \$15.60 billion annual business. He said, with strong individual operation with large debts. Commercial helicopter sales have not yet hit the steep part of their profit and growth curve, Garfield said, and he presented a 10% annual average short term forecast.

With no basic position in the large helicopter field, Garfield said, and does not intend to gain one. Future large firms either will be in consolidate the

company's strong position in the small and medium size class.

Garfield also forecasted growth in Textron's defense business in part of its overall priorities by Robert C. Thompson, Jr., Textron chairman, added that all Textron defense operations were forecasted to increase sales 1983.

Total 1982 sales for Textron were extended by Thompson at \$490 million and he said the defense area is where the company's biggest growth potential lies. He also broke down the sales proportion for the company's six basic areas:

	1980	1981	1982
Agricultural	\$ 6	\$ 10	\$ 17
Automotive	18	18	27
Commercial	11	11	11
Defense	39	21	34
Industrial	13	18	19
Residential	15	18	21

Profit contribution by each segment is approximately the same, although slightly higher. He said, "We are not profit margin area of defense and technology. Not emerging in 1983 should hold about the same proportion as 1982.

approximately 2.7% of sales of \$500 million or \$13 million after taxes. That would indicate approximately \$16 billion is expected in 1983.

Textron is attempting to increase margin through an expanded campaign in the defense in which units are reported quarterly. A 10% return on investment is the main goal set by the audited committee. The main long-term objective is not margin on sales, Thompson added, but a short-term conservative goal is to be sales margin would be 6%.

Textron's diversification plan, begun 10 years ago, was aimed at a 20% division of sales for each of what were then five groups. Sales in this balance have remained because of sales gains in such groups as defense, and some of the divisions lost but gained on a dollar basis, Thompson said.

Textron is most concerned with adding spectrum of the company's abilities will consider acquisitions, probably those that are supplementary existing products. Other products include:

• Textron Electronics, which is 75% owned by Textron, operated at a \$14



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constant rotor speed



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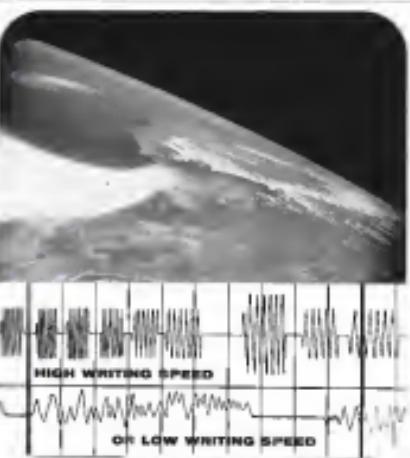
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gical profit in 1962 after showing a loss of \$800,000 in 1961. Sales volume of \$25-30 million is forecast for 1963, and a profit is expected.

*None change. In letter written to the company's broad-based interests outside the travel field has been considered. But the ideal name proved difficult to find, and it appeared to be easier to change the name of the Testras name that already is well known than to find and establish a new one.

PRODUCTION BRIEFING

Cluster of six Pratt & Whitney J58A7 engines will feed for the first time to a full duration test at the Douglas Structures facility. This cluster will power the S-4 Strategic second stage being manufactured by Douglas.

Marshall Space Flight Center has issued invitations to bid on construction of a Saturn C-3 dynamic test stand to be located at Marshall.

Republic Aviation Corp. has been awarded a \$156,500 contract to make overall sections measurements for the NASA machinist materials testing and analysis (SMM), formerly called Aeron. Republic was one of 12 companies bidding for the study.

North American Aviation will build wind tunnel models of a swept wing aircraft and an air inlet for aerospace studies by the National Aeronautics and Space Administration, under two \$89,000 contracts.

Radio Corp. of America has been awarded a \$369,800 contract from National Aeronautics and Space Administration's Marshall Space Flight Center for development of a solar radiation source to be used in environmental testing of the Apollo spacecraft. System will use carbon arcs to simulate the sun's radiation intensity.

Sylvania Electronic Products, a division of Sylvania Electric Products Inc., is conducting a study of drawings of precision, the placing of nuclear warheads on missile carriers. A \$345,000 contract from the U.S. Arms Control and Disarmament Agency, Scheduled for completion in 1963, the study will mean casting verification techniques in terms of basic missile control and environment needs.

United Control Corp., Redwood, Wash., has received contracts from Lockheed Martin and Space Co. totaling \$40,000 for development and production of programming and timing devices for use in the Polaris A-3 missile.

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PROBLEMATICAL RECREATIONS 158



The integers 1, 3, 8, N have the property that the product of any two when added to unity yields a square. What is N?

—Continued

A number of positions of a challenging nature are presently available at our Guidance and Control Systems Division for engineers experienced in gyro development and control system engineering. If you would like to contribute to the design of orbital space components and inertial technology, personally direct a resume to Mr. J. T. Lucy. Applicants may expect immediate consideration.

ANSWER TO LAST WEEK'S PUZZLE: In order for two similar triangles to have two sides the same, the side must be of the form $p\sqrt{p}$, p is an odd integer and p is \neq for the first triangle and p is \neq $p\sqrt{p}$ for the corresponding sides of the second. The difference between the two sides not common to the two triangles is, therefore, $p\sqrt{p} - p\sqrt{p} = p$. The only solution of $p\sqrt{p} - p = 17$ is p odd integers in $p = 1, m = 8, n = 5$. The triangles, therefore, have sides of 121, 329, 380, and 318, 289, 359.

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SPADATS SPACE SURVEILLANCE SYSTEM. Above, satellite collecting data from launch of Soviet hot iron missile on right; right, in the track of reentry missile exploded at Thule, Greenland, BMWES system. New British BMWES will have three such systems which will be used for surveillance and tracking. French BMWES will have six more that measure

Spadats Network Relies on Varied Sensors

By Philip J. Kuhn

East AFRL, Colo.—In the five years since Spadats 1 initiated the space age, the North American Air Defense Command (Nand) has assembled an effective space surveillance network using a variety of sensors, many of which were never designed for such purpose. The network is known by the acronym of Spadats—Space Detection and Tracking System.

For example, the Air Defense Command's Ballistic Missile Early Warning System (BMEWS) radars in Geckeroft and Alaska, in addition to their intended role, are primary sources of data on Soviet and U.S. satellites.

Other BMEWS type tracking radars

surveillance radars at Laredo, Tex., Trondhjem, Norway, and Iceland and at the Radio Corp of America's Mottertown, N.J. plant also play key roles.

Unclassified by Nand officials are classified sensors such as the BMEWS type radar in Turkey and those established by Discoverer, Mohn and Sputnik satellite programs.

Now the Space Surveillance System (Nongsat), the alphanumeric format which tracks more than the 10,000 objects in orbit, is being used to track Soviet satellites. The Soviet system, established by the Pacific Fleet, tests on the ICBM defense radars which are used to detect and track satellites when their regular surveillance passes.

Periodically reports are received from some of the hundreds of independent scientists or engineers around the globe since many of them operating with relatively inexpensive sensors. The total of sensor feeding data into Spadats

is around 470, Nand officials say.

During the month of December, Spadats obtained 159,000 individual satellite sightings, equivalent to one every 17 sec. around the clock.

Nand officials acknowledge the desirability of having additional sensors which would enable it to detect and track Soviet satellites more quickly and accurately. At present, they say, the Spadats system is too much data and too little time.

The pressing need is to be able to process incoming data more rapidly, to more quickly identify and establish orbital parameters for new Soviet spacecraft.

Opponents are divided over the likelihood that the USSR would attempt to put thermonuclear weapons into orbit. But until such time in the U.S. has the ability to inspect Soviet satellites, there is full agreement that we must rely upon keeping a precise catalog of individual satellites to watch for any sudden build-up which would suggest hostile intent.

Spadats obtains satellite sighting data from three classes of sensors, of which only the first is under Nand's operational control.

• Spadats sensors, consisting principally of Air Defense Command's Space-track

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Just tell me what you are, and the general idea of what you do, and your addition to decomplification will please.

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11—*MAIA* model. A German instrument goes *POOF*. It's a little two-in-one that measures ballistics and *GAIA* on the way to a new way of looking at the world of critical components.

**FIMA* (1982). Monolithic atomic force detector. Information, *200*. *Monolithic atomic force detector information, *200*.*

MULTIPLE SPECS ARE FOR THE BIRDS

Present transducers about 1" in diameter and 1.6" long are being easily to find. Some are hermetically sealed. Some take 25 G vibrations. Some have dynamic error heads down around 1%.

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sealed potentiometer output pressure transducer that withstands corrosive media and has a range of 0 to 10 psi minimum to 0 to 350 psi maximum. As a result of this accomplishment, you'll find about 26-draws of these multiple-spec beauties on every *Solim* booster. If you're interested, the name of the company responsible for this measurement over-the-haze and complete specifications on their 451519 pressure transducer will be supplied on request.



GIANNINI'S AIRBORNE STICK-SHAKER

Multi-engine aircraft used to vibrate when approaching a stall. Now, the big new jets can fly right on over. No vibration, no warning. Just off of a sudden, you're in the Twilight Zone.

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For details, ask a Carpenter pilot. Better yet, ask Gannini.



SATELLITE STATUS BOARD at North American Air Defense Command's Space Detection and Tracking System Operations Control Center, Colorado Springs, displays tracking information on all man-made objects in earth orbit. *200*. *Cloudspot* television piping information to control rooms at North American Operations Center.

aircraft. Now's the time and the *Cloud* 1000 television system, operated by the Royal Canadian Air Force.

* Other military sensors, which have proven sensors other than Spaldin, such as the Atlantic and Pacific outside walls and the radio in Turkey and for intelligence purposes (AW Oct. 21, 1957 p. 26).

* Non-military sensors, such as NASA's Mariner, *Skylab*, the Southeastern space network and university/academic facilities.

The relationship of ABC's space network, consisting of units of Air Force, Navy and *Skylab* and the *Space* in the *Space* Command's network, is not clear. At present it is difficult for us to determine the basis of distinction because Air Force has not yet published its own standards of performance. The situation further is complicated by the fact that the Spacecraft corporation operates several orbital parameters for both Space and *Skylab*.

Responsibility for operating Spacecraft, for providing the bulk of the *Skylab* service, for operating BMEWS and other non-military sensors is assigned to the 9th Aerospace Defense Division (ADD) of the Air Defense Command, under Col. Robert W. Weller. Col. Howard G. Land is vice commander.

The 9th ADD was organized in July 1962 when the Spacecraft division was made an operational unit and transferred from the IBM's Electronic Systems Division, Hanover Park, Illinois. The principal element of the 9th ADD is the *Skylab* Division, the first Air Force group to be assigned to operate a space station, a space module which is to be operated in orbit around the Earth.

Other elements of the 9th ADD are the *Skylab* booster, which supplies the *Skylab* with the necessary energy to operate the *Skylab* in orbit around the Earth.

**714* Surveillance Wing, under Col. Robert L. Marling, is responsible for operating the BMEWS stations in Alaska and Greenland and has a detachment at *Rehoboth* for initial operation of the third station at *Prudhoe Bay*. *2nd Surveillance Squadron*, recently formed but not yet qualified to become operational until July, will be responsible for operating the BMEWS stations in the *Midwest* and *Mid-Atlantic* regions.

North and *SAC* divisions also have responsibility for areas which lack *ICBM* launching sites and an extended area of control as well as the time of impact for each launch. A small display console has at the *Midwest* center continuously shows the operational status of every division of the two BMEWS stations, including such things as the position of older sites, status of errors and anomalies.

The *Mid-Atlantic* division has a monitor of the *714* Surveillance Wing and *Control Squadron*, which can pick up a telephone and instantly talk to either *SAC* stations or other *Skylab* stations, or using television cable, the other *Skylab* stations and communications. For *Skylab* communications, there are two example telephone circuits.

selected by Western Union, and will have a similar role in the audio *Mid-Atlantic* network, known as *Nodes*.

The *1st Aerospace Surveillance and Control Squadron*'s space surveillance responsibilities are to accept data on the thousands of incoming satellite sightings, convert it where required into a standard format suitable for processing by a *Philco 2000* computer to maintain a running inventory of every object in space. An equally important function is to calculate the time when even satellite will pass within range of each *Skylab* station in the network and the *Skylab* observation angle for that location during the pass to enable each station to quickly acquire and track the satellite.

Additionally, the *Spacecraft Center* has prepared a general bulletin giving orbital parameters on all unclassified satellites for use in *air and USAT* facilities. There do not give specific "look-angle" information for each of the hundreds of non-USAT satellites, but it is relatively easy for scientists at any location to calculate equivalent information from these general bulletins which usually cover a two-month advance prediction of orbital parameters.

Specific sighting data from the two

BMEWS Confidence High

Bob AFM, Color-Series Union in launching the space station satellite strengthens U.S. defense against a surprise *KBM* attack. The hundreds of soldiers and sailors of the *Skylab* and *Skylab* who have been trained *Skylab* Middle Early Warning System radio stations serve to increase the odds about continuous and to build confidence in the reliability of the *Skylab*.

Performance and reliability of the *BMEWS* system has been "underhanded," according to *Air Defense Command* officials here. The *Skylab* is significant because the facilities were designed and installed on a space-time basis.

Except for the *Skylab*, which started in October 1971, shortly after the *Skylab* stations were first activated when signals started off all the time and the computer was not programmed to disregard any noise, the system has performed without incident.

To progressively develop digital data link circuits which connect the *Skylab* and *Ground* stations with *Skylab* control operations center here are continuously improved to assure control and operation. Once every 24 hr. in the system, a given a complete operational checkup by means of typical programs.

Each of the *Skylab* stations, which are situated at the two existing *BMEWS* sites, *Thule* and *Mid-Atlantic*, has a monitor which continuously monitors and corrects which remain operational during the test. If an alarm were detected during the test, the *Skylab* automatically reverts to its operational status.

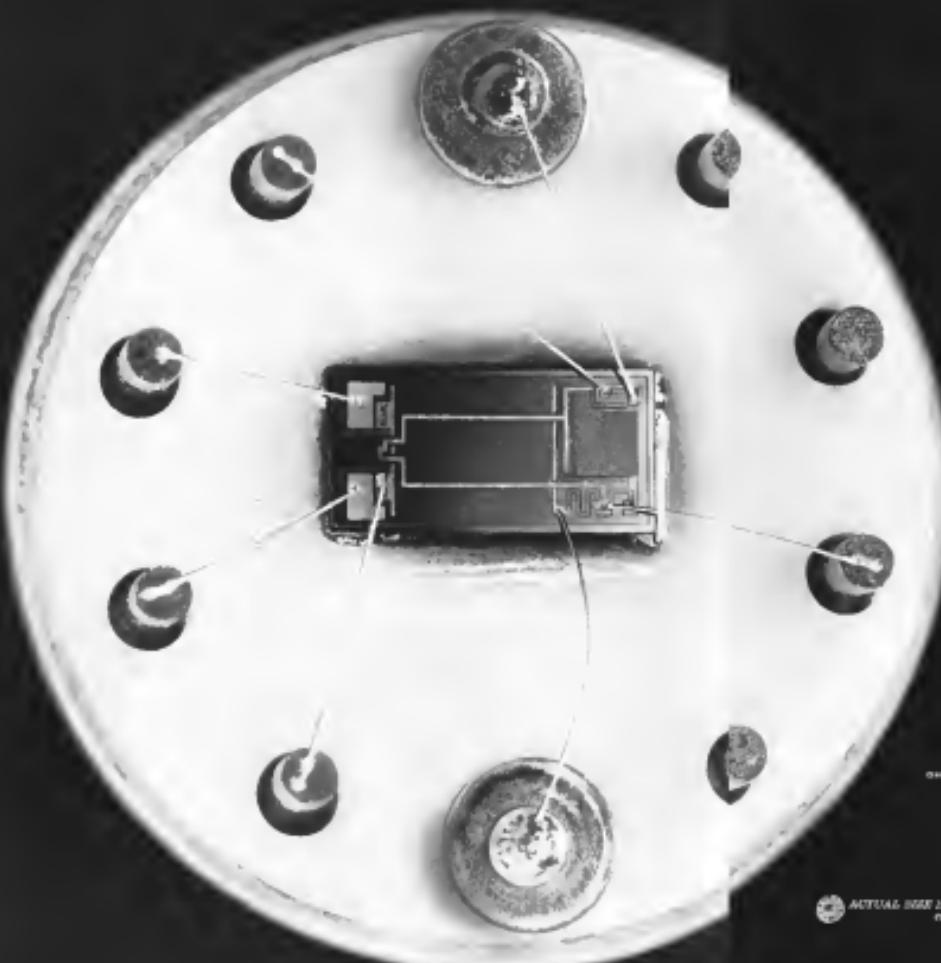
Radio relay equipment at each station is programmed at the site to discriminate between signals and noise, such as satellites, meteors, aurora and the sun. Any signal which qualifies as a threat is automatically displayed here on a large display screen of the *Skylab* hemisphere, as well as at *Skylab* Air Command Headquarters and at the *Mid-Atlantic* in the *Prudhoe Bay*.

North and *SAC* divisions also have responsibility for areas which lack *ICBM* launching sites and an extended area of control as well as the time of impact for each launch. A small display console has at the *Midwest* center continuously shows the operational status of every division of the two *BMEWS* stations, including such things as the position of older sites, status of errors and anomalies.

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MORE DATA

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BMEWS stations is provided by the Naval digital information processing (NDIP) board which is provided by the Space Command. From other range Spacetrack stations, the data comes in to a communication center. In this type, messages encrypted. Signals from foreign stations or universities can also be used. About 95% of the data, however, comes in the same form either in a form standard used by Nodal, or other standard which can be easily converted to punch cards and then converted to magnetic tape for transmission with the Plesio data processor.

Each observation for every satellite is fed into the computer section, which can store up to 900 observations for each satellite, according to Lt. Col. D. F. Newton, director of the Space Track Center. When the mean deviation between these recent sightings differs by a prescribed amount from the last calculated orbital parameters for the particular satellite, the computer calculates new orbital parameters which are then stored for comparison with subsequent sightings.

Judgment Required

Approximately 90% of the satellite sightings correlate well with the stored averages. It is the remaining 10% that引起 the attention of the Air Force mathematicians and analysts in the Spacetrack Center. Their uncorrelated sightings may signal the launch of a new Soviet satellite or they may indicate the death of a satellite that has been in orbit.

With relatively meager data on the down side of the world, the analysts will have to analyze 30 to 50 sightings to sight with more greater certainty as to the course of a year, it is difficult to progress a computer to automatically predict the satellite's parameters as it nears the end of its life in orbit.

These considerable human judgment factors account in order to accurately determine objects with previously cataloged satellites.

Data Processor

To Nodal and ADC officers committed to the fast automatic data acquisition and processing provided by the SAGE air defense system and by BMEWS the considerable amount of raw data, data handling and command required in Spacetrack and Spads with consequent delay, represents a shortcoming of the present system.

This, added to delays in detecting some Soviet launches due to limitations in present sensor coverage, could result in as much as four days delay between launch and the time that orbital parameters are established.

Plans are under way to procure an automatic data processor which will ac-

cept incoming data from major areas in trajectory format and automatically compare it for insertion into the Space Track computer. Current plans call for it to be installed and operational by mid next year. Data from Navy's Spads and Spads, obtained by analog form and telephoned or teletyped to Spads from Dulles, Va., is being used for this input. After processing in the Navy and Spads, the data can be transmitted as a form suitable for direct insertion into the Spacetrack computer.

BMEWS Computer

The BMEWS target identification computers originally were designed to discriminate between objects having ballistic and non-ballistic trajectories, tracking the latter and concerning themselves only with ballistic missiles (AWM 8, 1961 p. 70).

While all targets which penetrate one of the two BMEWS beams called a "Doppler," are reported automatically to Spads and passed along to the Spacetrack Center, these target values could be used in a more useful space surveillance scheme if another computer were installed at the satellite site to calculate orbital parameters which are then stored for comparison with subsequent sightings.

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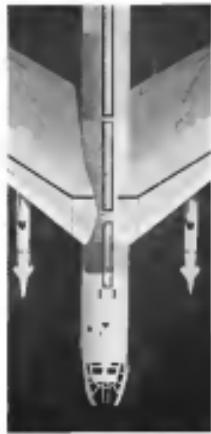
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The Aerospace Division of American Brake Shoe can be used to meet customer requirements to save as 100 pounds in aircraft maintenance. Aerokontrol has a composite aircraft maintenance system for the maintenance of aircraft. Aerokontrol can be used for aircraft maintenance by using composite materials.



BMEWS sites to give them this added space surveillance capability.

Sandi, an engineer, submitted to the Joint Chiefs of Staff she has recommended that the capability of the present Spuds network, to be extended in range beyond the present network, is not feasible.

Current inventory of satellites and other orbiting objects in space totals about 260, and the figure is increasing rapidly. To handle the increased work load, ADC plans to install a computer with greater storage capacity operating at higher computer speeds.

The Spacewatch center set up at Aerospace Systems Division, Hanscom Field when the network was first established as a research and developmental operation, continues to operate in a backlog facility for the center here at Colorado Springs.

FILTER CENTER

Space Charge Limited Trade—This filter space charge limited trade (SCLT) filter, 3 in. x 10 in. with a gate bandwidth of about 5 GHz, has been developed and is being produced by the Space Systems Division, Div. of Hughes Aircraft Co. The company reported last week, Device has a transmission in excess of 1,000 megahertz, a gate resistance greater than a terabars and exhibits sharp trade characteristics as a function of gate voltage.

Linear Mapping System—Preferred design of a remote film reader was low and a film reader system that could be used to map the film from a linearized system will be developed by Space Technology Laboratories for National Aeronautics and Space Administration. Film could have superior resolution but has been limited in many possible applications because of additional weight required for film processing. The reader will fulfill pulsed requirements.

Target Recovery in Space-Air Force's Space Systems—The company will investigate pulse techniques for determining range and range rate of maneuvering space vehicles at distances up to 250 mi. and beyond 1,000 mi. The range sensor is to be space based. Program probably will look at all types of electric magnetic radiation as a starting point.

Linear Power Control—Rockwell International is negotiating a contract award to Republic Aviation for an integration of laser actives (ultraviolet generation of light) based on chemical reactions.

Linear Microstrip Line High Gain—Details of a linear semiconductor micro-

FOUR MAJOR NEW PROGRAMS ASSIGNED MITRE

*Qualified Scientists and
Engineers Are Needed Now!*

1 AEROSPACE COMMUNICATIONS: Development of an advanced intercontinental communications capability has just been assigned to MITRE by the Air Force. Conceived by MITRE's Technical Staff, the new program will involve space technology as well as accompanying ground infrastructure. Engineers and scientists are needed now to help direct this major program. In addition to design, work will include test and system acquisition. Wanted are people with broad backgrounds in space electronics and technical management.

2 NUCLEAR DETECTION: MITRE has recently been assigned the task of providing the Air Force with system design of NUDETS in the 477 L Nuclear Detection and Reporting System. The system detects, locates and reports nuclear detonations that occur within specified geographical areas. Needed are qualified physicists and engineers with experience in nuclear, electronic and optical fields.

3 POST ATTACK Command and Control (PACC): The Air Force has recently assigned MITRE the task of being a system engineer for the PACC Program, a Post Attack Command and Control System. This system will enable the Commander-in-Chief, Strategic Air Command, to improve control of his forces in the event that a nuclear attack destroys or seriously degrades his normal facilities. To accomplish the task of system engineer and to provide technical support, computer people are now needed to help design the system, to write sub-system specifications, and to carry the system through advanced development stages.

4 U.S. STRIKE COMMAND: MITRE scientists are now completing a technical analysis of command operations, working closely with the Army and Air Force staff officers. More

men are needed to write specifications for computer programs and to conduct laboratory design, verification studies of logistics, intelligence, targeting, communications and other functions involved in joint task force operations. Needed are systems oriented designers with a good understanding of military operations.

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current amplifier which has a transconductance of 17,000 and is being used as a memory sense amplifier with the film memory of a small Unisys digital computer (I&W Day 24, p. 41) was invented by Spacelab Corp. The Memtran View Cell, however, has made dooms of three designs from Reming ton Rand design within an eight-week period. Packaged in three separate quartz and square glass laser packages, each amplifier consists of the stages—a differential amplifier, three stages of voltage amplification and inversion, and an output driver and output gating circuit. The amplifiers comprise the equivalent of a C-1000 computer, including 16 registers, 560 words and less 500 peripheral registers. Delays are 100 nsec and full times are less than 10 microseconds.

Hybrid Microelectro Effect Planned
Program to investigate problems in depositing thin film resistors and capacitors on a silicon substrate which has active elements already integrated on the crystal is planned by Aron Electronics Materials Agency. Research proposals are expected about Feb. 15.

Cryogenic Laser to Be Studied—New materials research to investigate solid-state laser configurations which will power



Syncom Data Reduction Computer

General purpose Electro Acoustics Co. digital computer will aid in reducing data returned by NASA's Syncom satellite. Computer, designated 3110, includes 16 bidirectional channels of sequential buffered input and output and has word word lengths of 14, 30, 36 and 45 bits. Memory cycle time is 1.5 microseconds, with 0.7 microsecond access time.

their operation at cryogenic temperatures is planned by Aron Electronics Materials Agency. Research proposals are expected about Feb. 15.

High Laser Efficiency Predicted—Use of gallium arsenide diode lasers as power sources for other types of laser crystals may yield overall efficiencies as high as

55%, according to Remington Rand Research Center scientists. High current densities of gallium-arsenide lasers have in the last ten years at relatively low average power levels, while efficiencies of other types of lasers is limited. The predicted energy savings can be available from lasers much of which is wasted. Nation-wide radiation emitted by crystals of gallium



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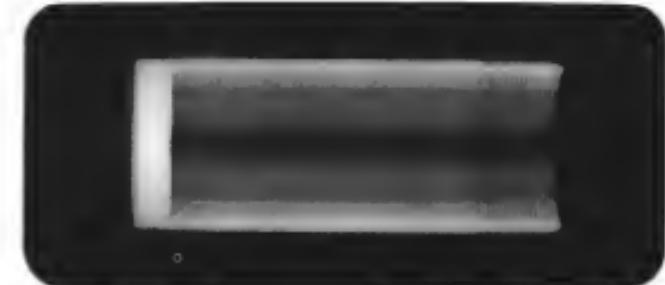
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Radiograph of rocket motor.



Frank B. Carvalho, right, project manager; R. J. Goodrich Aerospace and Defense Products Division, Rialto, California; and David F. Miller, project engineer, examine a radiograph of a rocket motor containing new high-energy composition of Nitro-G—rubber and explosive!

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Developed by Flexonics for the Boeing C-1 vehicle, the unusual flexible ducting system shown here is a P&D unit designed to deliver fuel or LOX to the gridded exhaust engine. At these engines move in response to gasolar acceleration, the fuel and LOX lines must provide for change of unit length, between engine and tank, up to 16%.

Problems design and build flexible ducting for the application is that whenever the engine moves, whatever the length of duct, the volume of the system remains constant. While because volume change could cause pressure change, and this in turn would cause asymmetric loading on fuel and LOX pumps, constant engine performance degrades as uniform supply of fuel and LOX to the pumps.

Flexonics engineers, working with engineers of the George C. Marshall Space Flight Center of National Aeronautics and Space Administration, Huntsville, Alabama, were equal to this challenge.

The arrangement of components in these permits an axial stroke of 16% of the free length of the compensator line. The internal compensation of the compensator line provides for pressure compensation during startup, the axial and endwise movement of the line maintains a constant volume in the duct. In a plane of motion.

The use of this combination of compensation and gridded ducting may end thrust due to internal pressure. As a result, say, fringe loading on the pump is then due only to acceleration forces.

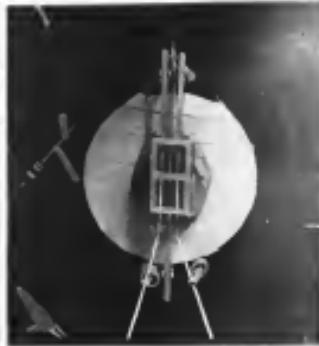
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ELECTROCHEMICAL MODEL of human nerve cell (left and right), based on demonstrated likeness between human nerve cell and cell model, shows important singular property of insulation. Cell elements are real, supported by other wires or cable and small screws.

Electrochemical Nerve Cells Under Study

By Barry Miller

El Monte, Calif.—Feasibility of realizing a logically complete computer function with an organic electrochemical model of a human nerve cell was demonstrated here recently by Space General Corp.

The demonstration of the action of inhibition with an electrochemical nerve cell is regarded as an important early milestone in a difficult progression of research steps aimed at ultimately making possible a related objective in computer technology.

Eventually, scientists hope to duplicate or simulate at the laboratory the operation of the human brain. This involves building a device using electrochemical neurons, or artificial nerve cell analogs to what cells in the overall circuit are thought to be. Having the capacity and the distinctive use of the human brain, such a machine will be trained or conditioned by itself and even according to Robert A. Steward, a principal investigator of the effort.

In contrast, the machine would differ from the self-training devices as in *Perceptron* (AW, Jan. 4, 1968, p. 72; Apr. 24, 1968, p. 99), in that the operator or operator would not have access to individual cells or their responses. Instead, training would be accomplished by observing the response of the machine in a given situation, then most easily shielding it to prevent it from



SPACE GENERAL PHYSICIST makes adjustments in electrochemical nerve cell experiment.

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responding in a similar manner under the same circumstances.

Stewart believes he has found the key to this difficult job of training in conditioning, although he has not yet conducted definitive experiments to verify it.

McCulloch-Pitts Neuron

Recently, he and his co-workers built and successfully demonstrated an electronic version of the simplest form of what is called a McCulloch-Pitts neuron, the simplest picture of what the human neuron actually does and so named for Dr. Warren S. McCulloch, a psychiatrist and medical doctor, and a former professor at Massachusetts Institute of Technology.

The cell has a multiple source of elements (three in the case built here) as a standard inhibitor circuit; when one input is fired, it causes the output to fire.

But in the event that two elements are fired, the third does not fire as effectively as inhibited from firing. This type of inhibition action is a logically complete and logically well-

defined function for complete neuron. Stewart points out, This would mean that action of this type might be the basis for the logic section of a computer.

Space General's work in electronics and robotics is being funded by the Bureau of Commercial Fisheries' Electronics Technology Laboratory, An Foss's Astronautics Systems Division. B. Leggett previously under congressional funding had a parallel 30 thousand-dollar experimental task conducted by Stewart while still a graduate student some years ago.

Earlier Experiments

The basis for these activities rests on suggestions made such as this century that muscle waves control what we eat, a movement in nature and man who eat a meat diet. When suggestion was followed about the time of World War I, by experiments conducted by the American physiologist R. S. Lalli.

He definitely showed that rats were in the area inhibited a series of clear cut characteristics similar to those of nerve impulses. Information on nerves rests primarily on knowledge of the



36' FOOT LONG TUBE, part of electrochemical nerve model experimental apparatus, is used for simulating traveling waves set up by nerve waves in an animal. Scientists hope to duplicate or imitate the operation of the human brain, which involves building a device using electrochemical sensors having the capacity and the distinctive use of the brain.



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spinal and peripheral sensory and afferent nerves not in the central shaft.

During Lefcet's findings, no nerve fibers in a single peripheral nerve were found.

• **Stimulation threshold**—from which date a threshold of excitation, which when exceeded will move the nerve to fire.

• **Threshold dependency**—The threshold fact that a spinal nerve is quite disposable but the nerve is injured in fatigue, or can undergo a period of inactivity. The voluntary period of fatigue when the nerve appears dead and a reflex action is still present during which the nerve will be fired if through the stimulus used, must be greater.

• **Spinal nerve propagation**—If a nerve is thresholded by a period of sufficient fatigue to move it, and again when later, the two exciting pulses will add together and should the superimposed magnitude

exceed the threshold level the wave will fire. Similarly, Lefcet found that propagation of a peripheral nerve is limited by the fact that it is not a single fiber.

• **Rhomboid-Nicobell**—in the rhomboid-shaped stimulation (impedance) at which self-threshold, integration will not take place.

• **Propagation speed**—The speeds of waves down the nerve were found to be roughly in the same range as those of nerve impulses in mammals about two or three feet per second. This appears to be an approximate relationship between the size of the nerve and the speed of the wave, probably due to an increase in conductance with increases in cross-sectional area of the nerve. Speed of propagation of the wave was found to be greater in isolated muscle nerves than that for mixed with mixed fatty fibers.

• **Action and machine potential**—A potential was found to exist between



'On-Off' Permanent Magnet

Spelco is demonstrating a new permanent magnet system developed by Westinghouse Research Laboratories. Permanent magnets attached to bars swing along an arm mounted to a fixed base. But like all other permanent magnets, they can be offset, too, and "off." The man can fire his four, take a step, then stamp it right again. The magnets need no constant source of electric power in the conventional electromagnets, yet they are easily controlled according to Westinghouse.

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on target with MCR—the Military Compact Reactor being developed by Allison for the Atomic Energy Commission. Lightweight and extremely mobile, it will generate 3000 kw. of electricity. The AEC selected Allison as prime contractor "on the basis of company capability to carry out the entire project." That kind of capability is also working in a creative environment on advanced turbo prop and turbo shaft engines, Missleman rocket cases and many other aerospace and nuclear projects, all of which are on target.

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30th Inventory of Aerospace Power Issue March 11, 1963

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the inside and outside walls, a potential is induced in the interior potential. An alternating potential is developed around the wires in the pulse goes by, thus changing during time of the pulse.

• **Resonance**—**Resonance** losses of wires were found to be considerably greater than those of wires, 15 cm in gauge length for inductors. On the leading the ratio between quantitative difference between wires and wires. Resonance losses and selection period were on the order of a few millivolts.

Some of the time wires materials were found to cause resonance effects. Resonance was highest between wires and two wires. Taking as it does the ratio of the practical values of the plasma length and the cathode gap was large, spread over the wires.

Now Space General has picked up and furthered this work, bringing the electrochemical method nearer to that point:

• **Sustained oscillating waves**—The company has sustained a wave pattern in a closed circuit wave for a period of five minutes and believes that can be extended for days, although longer with greater amplitude. This often the problem of a reverberating or oscillating circuit.

Physiologists believe, Stewart says, that closed paths are associated with memory but there is uncertainty about the duration of circulation and how extensive is evidence that type of memory in the heart. Prior to his experiments, 8.1 sec was the longest duration of a sustained wave. Besides oscillating waves which are set up when one of the two oppositely directed waves traveling along the excited wire is suppressed, a circulating wave in an electrochemical guidance wave, can be generated if one of the two counter directed waves is not suppressed.

• **Interference**—Previously, work with wire was done on single wires, but Space General has excited wires and coupled two with a third, the coupling achieved without metallic contact. Thus, coupling and interaction of a three has been demonstrated.

In the new electrochemical method bars and shapes are drawn, using photographs, wave of the fiber can wire control the motion. The polyethylene oil (petroleum) is positioned in the center thus resulting waves from one another. The electrolyte is water and the electrochemical source of that wave, which is the supporting wire, with the iron wire being cut, and with ends crimped to simulate a membrane and the iron tends to move wave action, making wave move from later. But this action is independent of the dynamic electrochemical wave action.

• **Moderation**—A wide range of behavior is produced in wire by the use of

different metals, the magnitude and direction of resulting currents can be controlled by different materials. Moderate, modified by their ability to also open, wave, series, time, etc., can be when metals in combination with iron. These would be used, good conductors, insulators, non-conductors and in series. They would be additional elements in any capacitor scheme.

• **Conditioning**—A drop in membrane, resistance which occurs when a wave is regarded by Stewart in the key to maintaining a network of electrochemical control elements. The drop has been measured as a factor of 10 in

ARE YOU A THICK WALL IDEA MAN?

Sharp-eyed designers are taking another look today at General Electric's tungsten and molybdenum thickwall tubes. They're finding new applications for these resistive coated tubes. What's yours?

Can you take advantage of the straight holes passing through the length of these tubes? Looking for an unusually small I.D. for the part you have in mind? General Electric can make the hole as small as $1/16$ " and O.D.'s up to 12". Lengths of only tubes to 50", tungsten to 30". And molybdenum only has a mafing

polar of 473°F., tungsten 419°F.

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It is seven inches in diameter. Each of its two hundred and eighty teeth is .0005" in diameter. The gear and pinion gear ground, so the gear's total size is less than five inches.

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denominator or the order of ten billion to a trillion parts per value load.

To select or reduce a part, Stewart says, will require fundamental advances in manufacturing methods so the mass of the parts need be individually handled. Each will ought to be on the order of micromechanical dimension, but a fairer world we could get it possible 10 micrometers in diameter, about twice the size of a 1000th part having a single value load.

Effects of atom type-size, conductivity, conductivity, and insulation could be considered and losses could result in a container the electrons could be heated and then cooled. What could be attributed to in problem is input strength and weight. Then the masses could be conditioned in a gravitational environment or a field and cross powers.

NEW AVIONIC PRODUCTS

- **Transistor heat-dissipator.** Known as Fan-Tip, its 100°F rise can reduce junction temperature by up to



25%. Applied for segments under load, radiators will double junction conversion efficiency when tested at operating a load. Device is available from stock. **Manufacturers:** International Electronic Research Corp., 131 West Magnolia Blvd., Burbank, Calif.

- **Variable frequency synthesizer.** Model 100A, provides prime frequencies from 30 cps to 10 mc in increments of



several 400 cps. Synthesizer has 10 columns of pushbutton arranged in

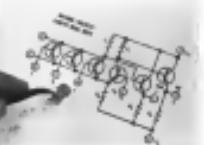
diamond to permit rapid selection of desired frequencies. Output voltage is 1.5 to 1000 volt primary load. Three frequencies for synthesizer are provided by comparison with Model 311A which has stability of three parts in one billion per day. **Manufacturer:** Hewlett-Packard Co., 1511 Page Mill Road, Palo Alto, Calif.

■ **Monolithic memory thermistor.** In precise control over temperature range of 0 to 1000°F, heat rise of 2000 mW is matched selected to memory cell size to

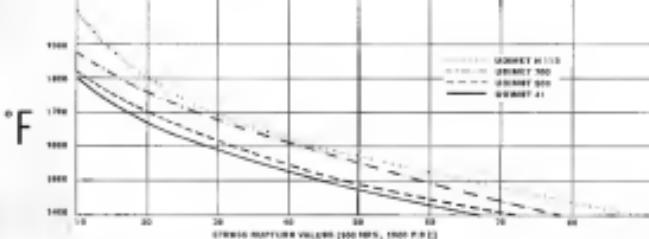


provide electrical signal. Controlled temperatures can be obtained and held within 0.05°C, according to manufacturer, and are available in a variety of sizes and configurations. **Manufacturer:** Philadelphia Scientific Glass Co., Philadelphia, Pa.

■ **High-speed logic gate with propagation delay of only two nanoseconds.** consists of six optically plane transistors and four in its conductive path. **Manufacturer:** International Electronic Research Corp., 131 West Magnolia Blvd., Burbank, Calif.



two transistors used as emitter followers output stage. Type MC3070 is used in but only two output stages to reduce power dissipation when logic operations are performed at the output of the gate. Propagation time is 575 picoseconds, depending on quantity. **Manufacturer:** Monolithic Semiconductor Products Inc., P.O. Box 955, Phoenix, Ariz.



It's all a matter of degree!

A matter of degree, yet—the degree of temperature, strength, ductility, corrosion resistance, and homogeneity. These are important factors when your applications are considered.

Perhaps, you are ready to consider vacuum induction metals. Take a look at the SELECTOR TABLE which lists some of the alloys SPECIAL METALS produces.

High Temperature Alloys

GURMET H 100 Monotectic, high purity low melt temperature, having no liquid. Developed for liquid metals on jet aircraft and missiles to withstand temperatures up to 1600°F. Ductility is excellent.

GURMET 100 Strong, high purity low melt temperature (1600°F). Presently used in operational gas turbine engines.

GURMET 500 An alloy similar to GURMET 100 in composition, with a maximum temperature range (1600 to 1700°F). Developed for high temperature applications.

GURMET 50 Ductility for service from 1400 to 1700°F. With superior stress rupture performance of the higher temperatures of the low temperature range, used in jet engine turbines and aircraft engine gas turbine components.

GURMET 40 An alloy for service from 1400 to 1700°F, excellent in stress rupture in low and high temperatures. Developed for liquid metal applications.

WASPALLOY First metal to be vacuum induction melted. It is used for temperatures up to service from 1000 to 1400°F. Developed for aircraft engines, aircraft gas turbine engines, and aircraft gas turbine engines. Also available for single castings and heat treated parts.

AT 1000 An alloy for service from 1400 to 1600°F, used for gas turbine buckets.

GURMET 700 A monotectic, high purity alloy with exceptionally high yield strength up to 1600°F for use in aircraft engines. Developed for service temperatures from 1000 to 1600°F.

GURMET 800 An alloy, relatively stable in stress and other heavy loadings, for operational engines. Stressrupture strength similar to GURMET 500 but lower.

Ultra High Strength Alloys

GURMET 2-200 Superior strength with maximum ductility and elastic toughness at a low cost per pound. Available from 1000 to 1600°F.

GURMET 2-500 Superior strength with maximum ductility and elastic toughness at a low cost per pound.

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- AT 1000
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- GURMET 800
- GURMET 2-200
- GURMET 2-500

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FAA to Test Simplified Cockpit Layout

By David A. Brown

First in a series of prototype light aircraft cockpit layouts to be developed by Federal Aviation Agency's Project Little Guy, will begin static simulation tests within two weeks in Washington.

Cockpit for four has justly developed by FAA and Matrix Corp. of Philadelphia, which contract to FAA. Static simulation with which includes lifting the prototype into a fuselage to check general arrangement, control locations, etc., will be done at Matrix, Inc., this week.

Design of the aircraft will begin about April with a modified general aviation transport aircraft, according to Dr. Douglas Gourley, executive vice president of Matrix Corp. and is attempting to design subsystems which can be tested in building blocks for economy, success, etc., this week.

Work is part of a program to develop light aircraft systems which will reflect the non-professional pilot of much of the world's work at flying the plane (AVN, Oct. 15, p. 187).

Cockpit must meet these requirements:

- Significantly reduce the time needed to learn to fly. Ultra-light goal would be for a person to learn in 5-6 hr. of use.

- Allow pilot to maintain performance with a minimum of tools and work.

- Increase the safety factor by making flying simpler and by designing systems for a specific general aviation function.

Current thinking is that a number of problems have developed because systems originally designed for military or commercial purposes have been adapted for general aviation use. Red cockpit lighting, for example, originally was developed to allow military crews to keep their eyes darkadapted while flying night combat missions. Red lights were used because the fact that they are more difficult to see.

Project Little Guy will consider the cockpit layout to be a cylinder transportation system, according to Dr. Douglas Gourley, executive vice president of Matrix Corp. and is attempting to design subsystems which can be tested in building blocks for economy, success, etc., this week.

Then a pilot who flew largely on weekends for pleasure would be able to have more time subsystems which were needed to have flight regimes. Other modules could be added as he began to fly more extensively.

In addition, if the pilot were maintaining a course of 90 deg. and wanted to turn to 270 deg., heading indicators would probably show him that a right turn of 180 deg. would bring him to the desired heading. Heading indicators also have been considered, but which, in the present layout, caused a digital indicator to show a predetermined 0 deg. heading.

To the right of the attitude display is a large vertical scale altimeter which is calibrated to 10,000 ft. Windshield, approximately 4 in. deep by 1 in. wide, shows aircraft altitude at the center of

the instrument panel. The display consists of a moving dot which is superimposed on a map of the area being traversed.

Matrix-crafted, four-seat attitude display with a green "body" portion and a blue "dot" area is located in front of the pilot. By making the attitude display rectangular rather than round, it was possible to eliminate the traditional number sequence for horizon reference and still retain accurate attitude reference.

Immediately above the attitude display is a horizontal liquid speed radio-

meter. The attitude display is a liquid display, a dot is a horizontal plane which indicates the aircraft's direction as well as the relative position of sun and other bodies.

For instance, if the pilot were maintaining a course of 90 deg. and wanted to turn to 270 deg., heading indicators would probably show him that a right turn of 180 deg. would bring him to the desired heading. Heading indicators also have been considered, but which, in the present layout, caused a digital indicator to show a predetermined 0 deg. heading.

To the right of the attitude display is a large vertical scale altimeter which is calibrated to 10,000 ft. Windshield, approximately 4 in. deep by 1 in. wide, shows aircraft altitude at the center of

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Beech Musketeer Delivered in Britain

Beechcraft Model 25 Musketeer sold in Britain, 11th of production line, was delivered at Gatwick Airport recently. Airplane was flying 100-hp engine, has 135 mph cruise speed, can carry 4 passengers. Maximum range is 900 mi. It has dual controls, full instrumentation with cockpit-mounted vacuum system, cockpit, dualized radio gear (AVN July 16, p. 64).

EQUIPMENT

STOKES NAMED PRIME CONTRACTOR FOR NEW DOUGLAS SPACE FACILITIES



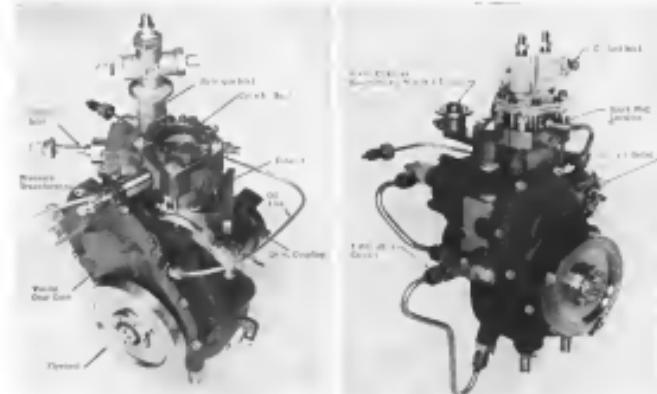
Author's concept of Bright-ARkit Environmental Test Center. SKATE's environmental test center is built to test and verify sensor data for various industries. To the left are two boxes. It is a box. One is orange and the other is blue. They are arranged in a 2x2 grid.

The Rockwell Space Systems Department has been named prime contractor for the design and construction of three new space environment simulation chambers, to be situated at Douglas Aircraft Corporation's privately financed Space Systems Center at El Segundo Beach, California. The largest and most technically advanced aerospace test laboratory on the West Coast, the Center will be an integral part of Douglas' Missiles and Space Systems Division.

The largest chamber, 38 ft. in diameter, will be capable of housing fully assembled vehicles, scheduled for man-rated flight. It will be used in the Bantam program, and in the development of lunar and planetary probe vehicles. The shaker systems will represent the most advanced state-of-the-art in capability, and are designed for updating to even higher simulation parameters in the future. Shaker units similar to these are now vibration-vacuuming in the 38-10-Torr range. High-speed cryopumping on all three chambers at 300°K. will assure the attainment

P. J. STOKES CORPORATION: PHILADELPHIA / LONDON / TORONTO

STOKES



TWO HYDROGEN-FIRED power systems built by Vulcain under 48-Four feasibility studies to determine a potential for driving space power systems are shown above. Oxygen injection systems (left) proved successful during tests. Main difficulty encountered was oxygen leakage into cylinders through randomly selected oxygen nipples. (Cylindrical oxygen flight) was developed after engineers demonstrated, measured, analyzed by wire and playback, into the hydrogen-oxygen nozzle closure.

Piston Engine Space Powerplant Designed

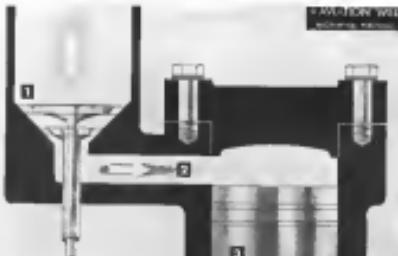
B. Ward Wright

Hydrogen combustion engines using hydrogen and oxygen as propellants to drive space power systems are being developed by Volker Aero Hydraulics Division, Fremont, Calif.

Volmer is working on a complete electrical generating system, driven by an internal combustion piston engine utilizing hydrogen and oxygen boil-off as propellants, under a \$197,000 technology advancement contract from National Aeronautics and Space Administration's Lewis Research Center in Cleveland.

System will be in the 500-watt range, powered by a 5-kilowatt micro-stirling power plant of about 3 cu. in. piston displacement. Contact calls for evaluation of the complete system including absorber, regenerative heat exchanger, inlet gas compressor and power controls.

Engas will operate on the hydrocarbon cycle and long a propylene propylene co-
monomer is added to the polymerization
reaction with a strong possibility of
the switch on contact to produce a soft
polymer.



SCHEMATIC DRAWING illustrates principle of dual concentric valve power control and air Valves' hydrogen-oxygen internal construction that equals bulk valve Air Flow control. Hydrogen gas at greater than combustion chamber pressure is ported over dual concentric valves (3) to air setting when valves are closed. Valuable adiabatic effect is achieved by keeping flame of either upper or lower valve and varying timing of the effect, or, by varying timing of both valves simultaneously. Hydrogen is admitted in distance volume (2) when piston (1) is at top dead centre. Oxygen injection is not shown.



Saint Gaudens de Coriolis: "A particle which is subject to no forces in a rotating coordinate system experiences a radial acceleration and a tangential acceleration."

It was around 1840 that Coriolis discovered what has since become known as the Coriolis Effect. He noticed objects above the earth tend to rotate relative to the earth's rotation. . . to the right in the northern hemisphere, to the left in the southern.

The Coriolis Effect is in force in outer space, too. If a space vehicle is rotated in order to establish artificial gravity, the excessively short radius of the rotation causes a Coriolis force. This creates orientation problems for a human occupant. To eliminate this difficulty, a scientist at Lockheed Missiles and Space Division conceived the idea of connecting the vehicle to an auxiliary fuel tank by a half-mile-long cable. Then, if the whole system is then rotated at a reduced speed around its center of mass gravity, the longer radius greatly reduces the Coriolis force. Right now—no flying hardware at Lockheed—*is* an extremely advanced space vehicle system which utilizes this concept, in addition to many others.

Fortunately, astute men are about the only restrictions which chronicle scientists and engineers at Lockheed Missiles & Space Company. The climate in Sunnyvale and Palo Alto, on the San Francisco Peninsula, is close to perfection. The creative atmosphere—the opportunity to work on such important projects as the Adams Satellite series, the POLARIS, and many more advanced concepts such as the space system stills above—is the climate of the creative engineer.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-18, 380 North Mathilda Ave., Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required. An Equal Opportunity Employer.

LOCKHEED MISSILES & SPACE COMPANY

A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

Systems Manager for the Navy POLARIS and the AGENA vehicle in various Air Force Satellite programs. Other current projects include such NASA programs as the OAO, ECHO, and SMMUS.

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ing liquid-hydrogen/liquid-oxygen and liquid-hydrogen/kerosene space power systems for NASA.

Videler has been promoting the liquid-hydrogen/kerosene combustion space power system as a competitor to the liquid-hydrogen/kerosene system from TRW for the company's contracts, particularly long-haul.

Booster weight on earth needed to carry a 1,000 lb. hydrogen/oxygen internal combustion space power system capable of a 7.2 km constant load through its mission, that is, the booster weight profile, would total 441,000 lb., according to Videler's figures.

Piggyback on a 747, basic landing mission weight would include a seven-day liquid store. Liquid-hydrogen fuel cell storage would have a 570,000 lb. booster weight profile. For the same mission, again, the system weighed 1,420 lb. Weight of both systems assumes redundant components for equal reliability and includes weight of propellant tanks and heat exchangers.

Reasons for the discrepancy in the higher propellant weight—1,530 lb.—for the internal combustion system come with the fuel cells' 670 lb. per propellant weight. The internal combustion system would consume more of its total weight than the fuel cells, leaving a lower weight to be boosted for the return trip.

Videler says internal combustion power engines for space power systems have three inherent advantages:

- Availability with minimum effort through use of existing technologies.

- Low weight. Hydrogen/oxygen power engines have a good specific propellant consumption matched with the lowest fuel weight of any space power system currently under development.

- Versatility. Pulse engines allow great design flexibility and can be incorporated into a space power system in several ways. Pulse engines can be used in a tank-and-pump system including a electrical power supply in addition to direct power needs aboard spacecraft. With the aid of self-contained fuel tanks, pulse engines could be used to generate power cells on the heat surface, the company feels.

Normand E. Morgan, Videler space power systems group engineer, outlined experiments with hydrogen/oxygen internal combustion engines under Air Force contract.

Two water-cooled test engines were used. One water-cooled the oxygen regenerator and cooled hydrogen through a pump taken from the existing rocket engine. The second engine, which was designated the "uncooled," was enclosed in an external housing, enclosing plenum prior to their being fed into the cylinder.

Of the two, only the oxygen regenerator

mechanical & structural engineers for aerospace vehicle projects

Rapid expansion of Hughes Space Systems Division is creating attractive openings of long-term opportunities for Mechanical and Structural Engineers. Projects include: NMRSBM—Mobile Mid-Range Strategic Missile (Booster, Assembly & Checkout), TFX (10) Blockers, SURVEYOR (Surveyor), SYNCH (communications), RAMES (Radar), and RAMI (Aerospace vehicle systems). Excellent working environment includes well-equipped laboratories, air-conditioned, private and team private offices. □ Hughes Space Systems Division is in Culver City, just two miles from the Pacific Ocean—away from the smog and high-density traffic areas. □ Intermediate openings exist for qualified junior and Senior Engineers in the following:

STRUCTURAL DESIGN ENGINEERS

For design of engineering and maintenance of structural and mechanical systems. Some positions involve procurement, packaging, test facilities or integration of equipment, as represented and as needed.

ELECTRO-MECHANICAL ENGINEERS

Positions involve design of space vehicle harness and cabling, design of thermal, working load, intermediate, overpressure or damping procedures, return factors.

SR. MECHANICAL ENGINEERS

Positions require basic knowledge in design of missile or aircraft-type structures and components, propellant storage, interstage separation, thermal insulation, vibration procedures and requirements and the principles of design design graphs.

TEST ENGINEERS

Positions involve design and static/dynamic testing of aerospace parts. Required is ability to establish test requirements, plan, direct and perform test activities, interpret test data and evaluate results of test and preparation of test reports.

MECHANICAL DESIGN ENGINEERS

Extensive experience is required in structural design and materials for space applications.

Basic requirements include a minimum of four years of related experience and an undergraduate degree in one of these fields of engineering. If you feel that your present and future interests you for one of these professional assignments—just fill out the coupon enclosed with a brief bio. We're interested in individuals who will live their loyalty. Please return your resume.

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Compressing Real-Time Human Effectiveness

—one approach is to split tasks into subunits of the command and control data problem—the amount of information that can be reliably gathered and stored... and the amount that can be presented to the human decision maker as read-time without exceeding the potential of human saturation.

An illustration of this double-harvested systems approach may be seen in the *Remote Air Command Control System* 4000, the first of the ITT International Electric Corporation's *Primes* Control.

Data enters the 4000 E subunits from Remote Communications Centers all over the world. Each 4000 can accommodate as many as 1,500 messages per hour by means of up to 32 input/output devices. All messages transmitted within the System are automatically readied, recorded, and monitored by Data Transmissions Control Centers at each of the 4000 Headquarters. Information flows are into Data Processing Centers, where a high-speed computer compiles events reported

by RCC's with prior stored in its memory. The RCC will automatically insert the SMC with its key significant decisions between action and planned events.

At the critical man/4000 interface, assimilation of the vast quantities of information flowing into SMC command centers has been considerably enhanced by a new real-time data presentation or *color display* of options that appear as an event or a short timeago. The new display system enables computer output devices to be converted to video-mosaic form—photocell—developed and perfected under large control center screens or in as many as 7 subcenters in a network of stations.

To learn more call Princeton, New Jersey, facility, you'll find a complete equipment catalog of 4000 E, occupying over 20,000 square feet in an air-tight test facility. With saturated experience in the field of real-time data processing and control, we invite you to sample the many unique control and information systems our engineers wish to stamp... in flight or on line.

OPPORTUNITIES IN MANY COMMAND AND CONTROL AREAS NOW OPEN TO SYSTEMS ENGINEERS, ANALYSTS, AND OTHERS

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sensor posed a practical problem—

Omega's signature version admitted hydrogen through dual converging propeller valves—the valves parallel with the rest of the baffle, rounded one step the baffle with the upper valve then the lower valve through the baffle, step the lower valve.

Both valves closed a massive 45 deg tapered nose and were located at the nose of the cylinder baffle, as the rest of the cylinder baffle, as a conventional Liquid automobile engine.

Unlike an automotive engine valve was prototyped onto the cylinder over the top of the valve rather than beneath it. In this way inlet gas at greater than combustion chamber pressure is prevented from striking the valve and closing it in mid-the cylinder.

By varying the phase of its intake valve valves in relation to each other, a variable adiabatic effect was achieved to the test engine phase changes were made by stopping the engine and varying the timing of the intake valve timing.

Eight tests were run on the power test method intake varying the intake valve or plenum gas delivery to vary the valve phase while the engine was running. Marga and Omega valve timing was controlled by a regulating pressure.

In the NASA program, other power control techniques, including those being tested, Marga said.

Engine does not have a true compression stroke in the sense of a baseline four-bore two-stroke engine. Instead the hydrogen-aircycle under pressure is admitted to a downstream volume, before the intake air passes into the cylinder.

In a flight system, the vacuum of space would surround the cylinder through the exhaust port. In the test engine, atmospheric pressure allowed this residual exhaust gas to remain in the cylinder and be compressed on the upstream thereby reducing the efficiency.

Ignition was achieved by a spark plug until the engine warmed up, which pre-ignited charge burned spontaneously as the engine was subjected to the hot cylinder.

One design problem involved the oxygen system, which tended to leak during tests. Oxygen leaking into the cylinder baffle caused constant heating which caused heat-welded propeller valves and did not add to power.

By the time the engine was ready for test was conducted from the test cell to a low load combustion cell and allowed to run hot. Engine was designed with automatic contact between flame and skirt to block heat transfer.

Specific propellant consumption ranged from 2.75 lb in 3.1 lb per hr, with ambient temperature inlet gas admitted at an intake to hydrogen ratios of 0.9 to 1. Margin and thrust consumption better than of turbines at the 7 in. fly levels developed during the tests.

Specific propellant consumption can be reduced further to 3.2 lb per hr by increasing the inlet air temperature, Marga said. Lower inlet gas velocity due to increased temperature will cut the pressure loss at the valves and again lower the consumption to about 1.8 lb per hr.

Oxygen to hydrogen ratio increases to 2.1 will raise exhaust gas temperature to allow inlet gas reorganization to 0.667 which should drop the specific propellant consumption to about 0.8 lb per hr, Marga said.

Carbureted vapor required maximum exhaust oxygen and weight not available to the engine.

In a flight system, the vacuum of space would surround the cylinder through the exhaust port. In the test engine, atmospheric pressure allowed this residual exhaust gas to remain in the cylinder and be compressed on the upstream thereby reducing the efficiency.

Two developed concepts, causing propellant and fuel tank into the engine chamber. Uncontrolled combustion chamber cooling can Vicks to drop the design.



Wind Machine TF33-P-7 Turboprop

Lockheed built portable wind machine which can generate crosswind of 135 mph., is being used to demonstrate adiabatic cooling during simulated start of the Pratt & Whitney TF33-P-7 turboprop engine which will power the C-141 transport.

AIRPORT WEEK & SPACE TECHNOLOGY, February 10, 1982

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WHO'S WHERE

(Continued from page 23)

Honors and Elections

Dr. Walter J. Bissel, program manager of the Air Force's Space and Missile Test Center, Los Angeles, and Charles Vough Corp., have been appointed a permanent member of seven-task advisory group for the House of Representatives' Committee on Science and Astronautics.

J. G. Westlock, corporate vice president of Checquale & Fenton, Inc., has been elected president of the Helicopter Association of America.

Brig. Gen. Willard W. Miltzkin, now commander of the Bellows Air Materiel Activity, has been elected chairman of the Air National Guard Council of the Air Force Association. Gen. Miltzkin is the senior representative for Northrop Corp.'s Newell Div. in Washington, D. C.

Changes

Col. Ed D. Dow, USAF, has been named Program Manager of the Federal Aviation Agency's Space and Missile Test Center. He succeeds Col. Leonard S. Roche Jr., now assigned to the Office of Material Support Flight Air Force Systems Command, Andrews AFB, Washington, D. C. Also, Richard B. Tamm, Director of the USAF Institute of Space and Astronautics.

Albert P. Monk, manager of engineering, United Aerospace Division of United Electronics Inc., Pasadena, Calif.

William L. Gross, director of reliability technology, Northrop Corp., Van Nuys, Calif.

Lois W. Randolph, chief of the newly formed RF Systems Development Section, California Institute of Technology Jet Propulsion Laboratory, Pasadena, Calif.

Charles G. Barnes, deputy director, Aerospace Systems Division, Air Force Systems Command, George E. Boeckel, manager, the Ohio Division, Defense Research, Air Traffic Service, USAF.

Frank R. Herold, assistant chief engineer for advanced development, TRW Inc., Redondo Beach, Calif., has been promoted. R. Karchell succeeds Mr. Herold as manager of metals marketing.

Donald E. Vining, chief of flight operations, Shirley Aircraft Div. of United Aircraft Corp., Springfield, Mass., Robert A. Decker succeeds Mr. Vining as chief test pilot.

Frederick Mousoures, manager of process control, American Electronics Inc., Fallbrook, Calif.

William D. Snyders, manager of controls and systems, General Electric Co.'s Computer Dept., Phoenix, Ariz., succeeds William G. Baucus, now manager of GE's Information Processing Center, Cheyenne, Wyo. Alexander F. Bresler, control director of electronics, Space Technology Laboratories Inc., Redondo Beach, Calif., succeeds A. W. Thompson, Space Division, manager of the Space Division, Space Technology Laboratories Inc., Redondo Beach, Calif.

William J. McCloskey, product manager, Maintenance Div., East McCallum, Inc., San Carlos, Calif.

Warren C. Davis, manager, military and avionics, sales, North American Corp., Lancaster, N. Y.

weapon system operations analysis

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It is immediately apparent research done on paper, on a slide, The intent of point on developing system design criteria is to work fast with the best that exists today in theory, technique and equipment—then to proceed to experimental development and field demonstration. Techniques will be applied in the design, analysis, construction, test, evaluation, and modification of the system.

In the last year, the program of Jeopardy, studies and engineers is to build and expand a technical capability which will strongly influence the future growth and development of the whole field of satellite communications.

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Men are planning to walk on the moon before this decade is over. And when a human sets foot for the first time on a celestial body other than earth, the consequences may be far more profound than Galenitus' opening of the New World.

A P O L L O

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PATRIK AIR FORCE BASE is now creating the range technology for launches of DYNAPROP, GENERAL APOLLO, ADVANCED SATURN BOOSTERS,

LETTERS

Soaring Contributions

I read with interest the article entitled "Antonov Seizes Soviet Space Antennas" in the *Business Flying* section of the Dec. 24 issue of *Aerospace Week*, pg. 771, where O. G. Antonov takes the Soviet to task for breaking out of the country's Major Gliding Competition which will be held in Argentina in February.

In the latter portion of the article it is mentioned that the USSR has not been represented in the four World Gliding Championships. The four most recent World Gliding Championships were held in the 1958 World Gliding Championships which were held in Ljubljana, Poland. It was not a really success meeting, due to the few borrowed gliders, equipment and facilities available at the time.

The American situation is the reverse of that in the USSR. Here the decision to compete is made by the Gliding Society of America—the soaring enthusiasts, not pilot manufacturers. The four most recent meetings are the U.S.A. represented in the FAI through the NASA. Also when the Russian gliding movement is a government project, here in the U.S.A. it is a private, sporting venture.

At the present time, the Gliding Society of America is conducting a fund drive to raise funds to enable them to send a team to the Championships in Argentina.

Any support you can give this effort would be greatly appreciated.

Tom Cope

The Gliding Society of America, Inc.
El Paso, N. M.

Foggy Terminology

Generally speaking, I have a very high regard for the writing of *Aerospace Week*, articles on many subjects, but I would like to bring your attention to one language in which the term "all weather" is used.



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Aerospace Week welcomes the opinions of its readers on the items raised in the magazine's editorial columns. Address letters to: Editor, *Aerospace Week*, 229 W. 42nd St., New York 36, N. Y. Try to keep letters under 300 words and add a signature identification. We will not publish letters that contain names or initials of writers not withheld as requested.

Many aircraft manufacturers are now using this expression to indicate that their aircraft can fly in any type of weather, but I do not.

To me, "all weather" means what it says and not the ability of an aircraft to fly under all weather conditions, rain, fog, or crystal, icing conditions, etc.

For example, several military aircraft have been stated to be "designed to meet all weather requirements," but here we are talking of regular weather, windscreens, air temperature, etc. I would like to point out that these aircraft have demonstrated an ability to fly in any type of weather to C-130s or MIG-15s requirements.

As an avid reader of your magazine, I would like to see a much better description of what "all weather" means. I would like to know the difference between "all weather" and "all-weather," and I hope that you apply your expertise this will be possible.

George E. Warren
Denver Technical Sales
The Boeing Co.
Seattle, Wash.

Insurance and Safety

With this last issue in your Letters column about insurance policies and insurance companies, I would like to add a few comments between these two important subjects. I offer my views, for comparison, as follows:

The single largest error makes during the life time of a policy is to believe that a single premium is all there is to a much higher total income. Consequently,

a life insurance (policy) is often ruined by more time pushed and by no money is remitted.

2. Auto loans automatically acquired in insurance companies are good, but are insurance automatically as soon as they are in re-insuring position, an automobile club, a credit union, a bridge club and other aggregations of our modern society, not to mention many other substantial life insurance policies normally provided by the re-insurer employer.

3. Such an individual pays directly or indirectly, several premiums toward medical protection, and let us have insurance on an individual basis to obtain benefits at have been frightened to do so.

4. Only qualified or highly experienced insurance companies should pay to a life plan. Those having some talent will probably lose if being forced to pay from various sources to obtain the right plan.

5. It seems to be shared in least the amount of protection required as desired by a citizen on the part of the nation, as much as it was ridiculous to reduce the size of aircraft carriers by the Japanese. One need not be afraid with the others.

6. Accident protection of the respective nation appears to be an obligation of the nation. If they cannot accomplish this duty, they should call on the local police for help without requiring a right of re-insurer status in their free country of ours.

James Stevens
Vice Pres., Calif.

Satellite Identity

At the January 29th, 1962 meeting the Society of Satellite, 1962 Alpha group.

In the satellite station report issued by the Smithsonian Astrophysical Observatory for the date 12/20/61 & in a Committee meeting 11/29/61, the following information can be found:

International name: Apls 1
Code name: astronomical
Source: unknown
Launch date: 30 Sept. 62
Status: unknown

International name: Apls 2
Code name: astronomical
Source: unknown
Launch date: 30 Sept. 62
Status: unknown

International name: Apls 3
Code name: astronomical
Source: unknown
Launch date: 30 Sept. 62
Status: unknown

(Note that the A is a lowercase witness for Apls 1)

Since the information does not appear in the USAF publications stated by *Aerospace Week* on Dec. 24, 1961, one is forced to ask, "Dad, the right hand knows what the left hand doesn't." Or, more likely, it is a fuzzy thing it makes some people—or agencies—look like golem!

Samuel B. Kramer
Boulder, Colo.

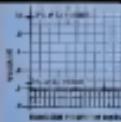
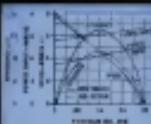
Clifton Precision announces 4 major improvements in Servo Motor performance



These motors provide more torque than ever before at lower power levels. This is a servo motor used in a control running engine.

Acceleration is improved in the standard range of 1000 rpm/min. to 2000 rpm/min. Up to 20,000 rpm/min. is possible, with no load.

This is the first improvement in an all-new, modern, general-purpose servo motor with new 20% servo motor and new ratios.



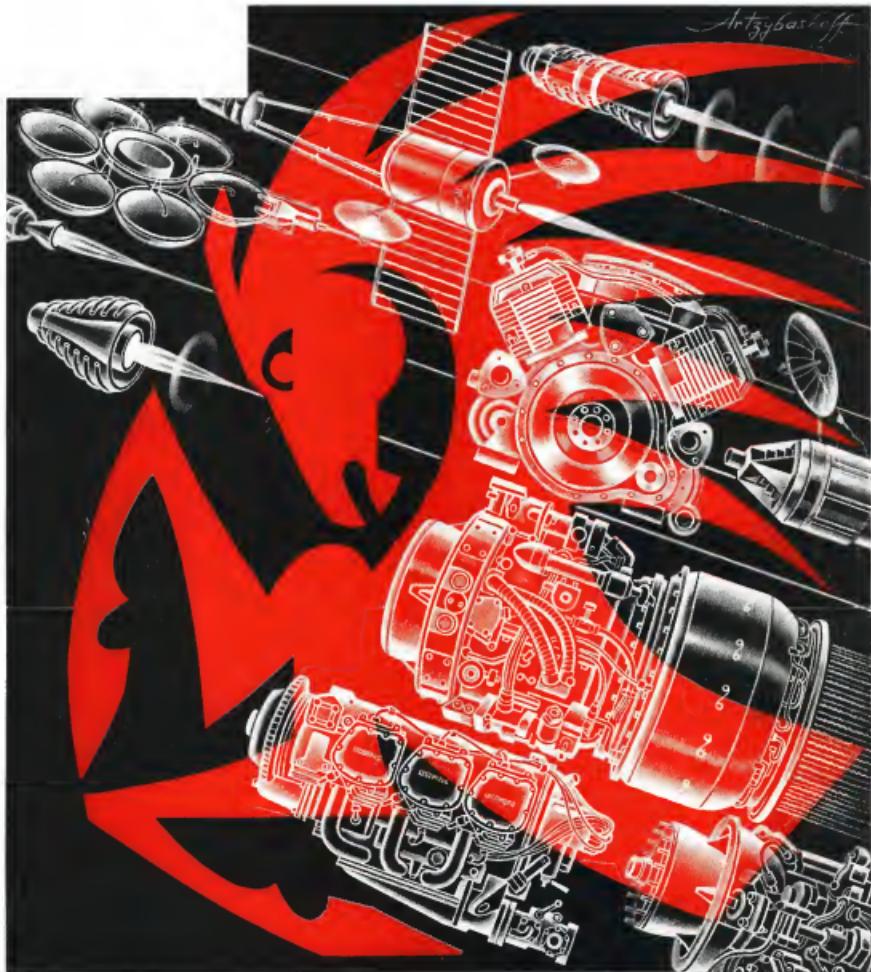
More starting torque has been specified at 25% increased power ratings, no new gear ratios 25:1 and 50:1 are now available. Furthermore, starting voltage of these motors has been reduced to reduce the load starting characteristics below what is currently practical.

New slot and magnet wire insulation is now much less susceptible to high temperature. In addition, the insulation materials used in insulation resist more than 2000° F. Also, insulation resistors are now incorporated in gear boxes to reduce motor life (all insulation are tested).

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FEB. 19 1963



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